UNITED STATES ATOMIC ENERGY COMMISSION

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Nuclear Science Abstracts

Volume 9 No. 23
Abstracts 7603 - 8020
December 15, 1955

Technical Information Service, Oak Ridge, Tennessee

NUCLEAR SCIENCE ABSTRACTS

Volume 9 December 15, 1955 No. 23

GENERAL

7603 TID-5281
International Cooperation Administration. Office of Industrial Resources, Washington, D. C.
ECONOMIC ASPECTS OF ELECTRIC POWER PRODUCTION IN SELECTED COUNTRIES. July 1955. 36p.

7604
SESSION OF THE ACADEMY OF SCIENCES OF THE U.S.S.R. ON THE PEACEFUL USE OF ATOMIC ENERGY. JULY 1-5, 1955. MEETINGS OF THE DIVISION OF TECHNICAL SCIENCES. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

Separate abstracts were prepared for the 18 papers compiled in this book. (L.M.T.)

7605
SESSION OF THE ACADEMY OF SCIENCES OF THE U.S.S.R. ON THE PEACEFUL USE OF ATOMIC ENERGY. JULY 1-5, 1955. PLENARY MEETING. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 106p. (In Russian)

Separate abstracts were prepared for the 5 papers compiled in this book.

BIOLOGY AND MEDICINE

7606 UCRL-3085
California. Univ., Berkeley. Radiation Lab.
THE PROBLEM OF SYNTHETIC LETHALS IN DROSOPHILA MELANOGASTER (thesis). Philip Elwin Hildreth. Aug. 1955. 29p. Contract W-7405-eng-48.

Experiments were carried out on Drosophila melanogaster to determine if lethals are formed by recombination between normal X-chromosomes of different populations and between normal third chromosomes of different populations. Statistically the results are in agreement with the hypothesis that recombination played no role in producing lethals in the X-chromosome or in the third chromosomes studied. Genetic localization tests, using different sets of markers in at least two separate tests for each lethal, indicate that there is no need to assume that a combination of loci or regions is involved in any of the lethals. The results of these experiments on the X-chromosome and the third chromosome are different from those of other authors who have interpreted their findings as showing that lethals frequently are produced by recombination in the second chromosome of several Drosophila species. The production of synthetic lethals in the second chromosome of those Drosophila species studied may be due to the fact that recombinant chromosomes were synthesized from chromosomes which were originally sub-normal in effect. Crossing-over is perhaps a factor in the production of lethals in natural populations but experiments on the X and third chromosomes indicate that lethality need not be expected to occur frequently as a result of crossing-over, especially if the parent chromosomes are free from pre-existing lethal or severe viability defects. (auth)

7607
ISONIAZID IN VITAMIN B_6-DEFICIENT RATS. Irene U. Boone, Donna Faye Turney, and Wright H. Langham (Los Alamos Scientific Lab., N. Mex.). J. Lab. Clin. Med. 46, 549-59(1955) Oct.

7608
RADIOACTIVE ISOTOPES IN MEDICINE AND BIOLOGY. V. K. Modestov, I. I. Ivanov, Yu. M. Shtukkenberg, E. F. Romantsev, and E. I. Vorobev. Moscow, Medgiz, 1955. (In Russian) (Book on display at Geneva Conference)

A practical guide for physicians and biologists working with radioactive isotopes. Part I contains elementary data on nuclear physics, deals with the problems of the interaction between radiation and substance, and with measurement techniques. Part II dwells on the use of radioactive isotopes for tagging. The concluding chapters contain data on protection against radioactivity and on equipping laboratories. Supplements for reference purposes are attached. (publisher's note)

7609
SESSION OF THE ACADEMY OF SCIENCES OF THE U.S.S.R. ON THE PEACEFUL USE OF ATOMIC ENERGY. JULY 1-5, 1955. MEETINGS OF THE DIVISION OF BIOLOGICAL SCIENCES. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

Separate abstracts were prepared for the 20 papers compiled in this book. (L.M.T.)

RADIATION EFFECTS

7610 AMRL-200
Army Medical Research Lab., Fort Knox, Ky.
THEORY OF INTERMITTENT RADIATION EFFECTS ON CHEMICAL AND BIOLOGICAL SYSTEMS. I. CHEMICAL SYSTEMS AND GENERAL FORMULATION. Richard W. Michie and Lawrence H. Krohn. June 10, 1955. 21p. AMRL Project No. 6-59-08-014.

A broad mathematical theory is developed which presents, using a postulatory basis, the overall mechanism whereby the chemical and biological systems behave under intermittent radiation. (auth)

7611 USNRDL-TR-55
Naval Radiological Defense Lab., San Francisco.
HYPERGLYCEMIA AND INCREASED LIVER GLYCOGEN IN RATS AFTER X IRRADIATION. R. E. Kay and C. Entenman. Aug. 1, 1955. 14p. Project No. NM-006 015.

A quantitative study was made of the effect of whole-body x irradiation on liver glycogen and blood sugar levels of the rat. Each of three experiments used fed nonirradi-

ated and fasted irradiated rats. The irradiated rats were prefasted 24 hr and exposed to 550, 750, 1200, 2500, or 5000 r, and analyses were made 24 and 48 hr later. Whole-body x irradiation elevated both the liver glycogen and blood sugar levels of fasting rats. As the dose of radiation increased, the percentage of liver glycogen at 24 hr after the time of irradiation also increased. At all doses, except 5000 r, the percentage of liver glycogen was about the same at 24 hr and 48 hr after x irradiation. In no case did the liver glycogen levels of the fasting, irradiated rat exceed that of the fed, normal animal. Blood sugar levels were elevated furing the first 24 hr after irradiation and continued to increase over the next 24 hr. Forty-eight hours after the time of irradiation the blood sugar levels were, in every case, greater than in the fed, normal rat. (auth)

7612

EFFECT OF IONIZING RADIATIONS ON THE ANIMAL ORGANISM. L. A. Orbeli. p.3-13 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

Some suggestions are discussed and experimental evidence presented regarding the tentative ways and means of development of the radiation injury. The line of procession of the "chain reaction" of the radiation effect is discussed. (auth)

7613

EFFECT OF IONIZING RADIATIONS ON THE FERTILITY OF MICE AND THE VIABILITY OF THEIR PROGENY. N. I. Nuzhdin, N. I. Shapiro, O. N. Petrova, and O. N. Kitaeva. p.14-33 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

Roentgen irradiation of male mice (200r and 400r doses) decreases their mating capacity and the litter numbers of those crossed with non-irradiated females. The latter is due to the high mortality of the embryos at various stages of embryogenesis. Among the progeny of the irradiated males there occur a great number of still births. One to three months after irradiation the fertility of the males is restored. The mice originating from ova inseminated with sperm developing from the regenerated germ cells do not differ from the control ones as regard their viability. The post-embryonic development of the progeny of the irradiated males does not exhibit any deviations from the norm. The number of litters from males of the first generation originating from the irradiated males is markedly decreased as compared with the control. It was found that the hereditary character of sterility is caused by roentgen irradiation. A single total roentgen irradiation of female mice disturbs the course of the oestrual cycle as manifested in a decrease in frequency of the oestrual and pro-oestrual stages and an increase in that of meta- and dioestrus. The degree of disturbance depends on the dose and length of the post-irradiation period. The minimum effective dose of a single roentgen irradiation is about 50r. The disturbance in the course of the cycles sets in after a certain latent period (one to two months) depending on the dose. Within a six-month period following irradiation (doses 50, 100, 200 and 400r) the disturbance in the oestrual cycle was found to be irreversible. The disturbance in the oestrual cycle as caused by roentgen irradiation is similar in character in mice of the A and C_{57}-black strain as well as in multipara and virgin females of strain A. A single total exposure of the females to 15 and 25r doses, although not affecting the course of the oestrual cycle, decreases their fertility. Chronic exposure to small doses of gamma rays likewise evokes disturbances in the course of the oestrual cycle in C_{57}-black females. (auth)

7614

LOCAL ACTION OF ROENTGEN RAYS ON VARIOUS DIVISIONS OF THE CENTRAL NERVOUS SYSTEM. P. F. Minaev. p.51-68 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

Application of the method of local action of radiant energy upon the brain as developed in our laboratory provides the possibility to study the switching off and recovery of cerebral activity. In this way evidence was produced to suggest that along with its great susceptibility to penetrating radiations the central nervous system is highly resistant to them as well. The functional state of the central nervous system can be altered by varying the radiation dose applied for a definite rather easily predictable time period. Irradiation of the cerebral hemispheres induces leucocytosis in the peripheral blood due to an increase in the neutrophile count. Irradiation of the cerebellum is followed by leucopenia in the peripheral blood resulting from a change in the neutrophile and lymphocyte number. In both cases some structural changes occur in the blood cells. These changes in the peripheral blood immediately following irradiation become especially pronounced on the 3rd to 5th day after irradiation along with greatly pronounced disturbances in the higher nervous activity. Leucocytosis is connected with an increase in the excitability of the nervous system, and leucopenia with its reduced activity. Local administration of penetrating radiations to the brain showed that phase conditions of the higher nervous activity are caused by definite doses of roentgen rays, and the "radiation shock", just like the surgical shock, involves the entire nervous system and hence the whole organism. It is only in the course of time that it can be localized precisely at the application point. The above method of local treatment with roentgen rays can be used for a more detailed and profound study of the physiological functions, not only of different divisions of the central nervous system, but of different departments of these divisions as well. This is ensured by the reversibility of the functions of different brain divisions switched off for various time periods according to the dose applied, by the lack of epileptic fits in animals, lack of surgical trauma and blood losses, and precise dosage of the radiation stimulus. (auth)

7615

BIOCHEMICAL BASIS OF BIOLOGICAL ACTION OF IONIZING RADIATIONS. A. M. Kuzin. p.69-84 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

The study of the primary biochemical processes taking place in the organism due to penetrating radiations is of

exceptionally great significance for the comprehension of the complex response of the organism to this physical agent. The energy of radiation absorbed by the living system is transformed into the chemical energy of the short-lived free radicals, peroxides, hyperperoxides and excited molecules. The unstable chemically active compounds formed at the moment of irradiation elicit, on the one hand, slow depolymerization reactions of high molecular substances (nucleoproteins, glucoproteins, etc.) and the formation of abnormal low molecular specifically toxic substances on the other. Radiosensitivity of the desoxyribonucleic acid (DNA) solutions was shown to increase in the presence of iron ions. The P^{32} labelled threads of desoxyribonucleoprotein were found to be extremely sensitive even to small doses of ionizing radiation. Depolymerization of DNA varies in different tissues and this is of fundamental importance in defining the radiosensitivity of the tissue. It was shown on model and natural systems that irradiation of protein macromolecules distinctly alters their absorption properties and complex-forming capacity. This results in a disturbance of coordination of the enzymic processes on the surface of the macromolecules, particularly in the inhibition of oxidative phosphorylation which yields the energy for the synthetic processes. Irradiation of plant tissue was shown to inhibit protein synthesis as indicated both by the incorporation of firmly bound deuteron and of C^{14} carboxyl labelled glycine. The disturbance in the normal synthesis of nucleic acids and of simple and complex proteins results in a disturbance and suppression of cell division and in abnormal growth. It cuts off the production of antibodies, increases the permeability of the tissues and disturbs hormone production. The change in the native structures of the macromolecules alters absorption and other intermolecular linkages, thereby causing "activation" and "inhibition" of individual enzymes, hormones and other biologically active substances which is usually the case at a later postirradiation data. These changes are enhanced by the specific action of toxic substances formed of the initial stages as illustrated by the behavior of the liver catalase. In the animal organism, the initial biochemical changes cause abnormal stimulation of the interoreceptors, thereby disturbing the regular function of the central nervous system. The disturbances in the carbohydrate, lipid and protein metabolism as noted at a later stage after irradiation are as a rule of a secondary nature and result from a change in the neurohumoral regulation. (auth)

7616

EFFECT OF IONIZING RADIATIONS ON SOLUTIONS OF PROTEIN AND OF PROTEIN COMPLEXES. A. G. Pasynskii. p.85–105 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1–5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

The following are the results obtained from a study of the effect produced by roentgen rays on crystalline human serum albumin, on lipoproteins of blood serum, nucleoproteins (of the thymus) and blood serum, as well as by gamma rays, and neutron radiation upon human serum albumin. The threshold of action was determined either by the common methods, such as absorption spectra in the infrared and ultraviolet, electrophoresis, viscosity, etc., or by means of the isotope method developed in this laboratory which is based on the increased binding of labeled methionine-S^{35} by proteins as caused by irradiation. The principal results are summarized in a table from which it appears that by means of the isotope method it is possible to detect molecular changes in the proteins and their complexes upon irradiation with doses (in thousands of r) 20 to 100 times less than those practiced previously for proteins, in particular, with biological doses of 400 to 500r. This result disproves the conception of strictly localized changes of nucleic acids and of nucleoproteins in the primary processes elicited by irradiation. In fact, these primary changes may occur throughout the the protein substance of the cell even with biological doses. As regards the nature of the primary molecular changes of proteins elicited by irradiation, it may be assumed from the evidence obtained that the chemical changes in the molecules of proteins and of their complexes (viz., rupture of the peptide bonds, splitting off of the components of the complexes, rupture of cyclic groups, desemination, etc.) should have no significance for the biological irradiation doses, except probably for partial oxidation of SH-groups. The changes in the ultraviolet absorption spectra elicited by irradiation, often considered in published works as an indication of chemical changes, were shown to disappear almost entirely upon elimination of the secondary aggregative changes (through addition of formamide, sodium caprylate, cysteine, etc.) Obviously of principal importance is the transition of the protein molecules to the excited or active state at the expense of the absorbed radiation energy. This is accompanied (as e. g., also upon heating) by structural changes of the type of rearrangement of part of the polypeptide chains which results in a decrease of solubility, increased aggregation of particles, increased binding of labeled methionine, etc. Although with biological doses these denaturing changes are rather slight, yet their accumulation in the multipartite and interrelated chains of the metabolic processes and the development of these chains of changes within the organism may become the cause of appreciable physiological disturbances and of high sensitivity of complex organisms to irradiation. (auth)

7617

THE PECULIARITIES OF INACTIVATION OF MICROÖRGANISMS BY MEANS OF RADIATION STERILIZATION. M. N. Meisel, T. S. Remezova, R. D. Gal'tsova, G. A. Medvedeva, N. A. Pomoshchnikova, M. N. Shal'nova, and V. M. Alekseeva. p.106–26 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1–5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

A comparative study was carried out of the radiation and heat inactivation of non-spore forming microörganisms (as exemplified by yeast cells) upon incomplete (85%) and complete (100%) sterilization. Upon incomplete sterilization, the ultimate lethal effect of irradiation and heat treatment was similar, amounting as a rule to LD_{85-90}. For complete sterilization, 1.0 to 1.5 million rep. of ionizing radiations were used, and for heat sterilization, autoclaving at 1 atm. Upon incomplete radiation sterilization (LD_{85-90}) the structural changes of the microbe cells are very insignificant, involving principally solidification of the nuclear caryosomes and of the protoplasmic organoids chondriosomes accompanied by a slight increase in their adsorption capacity. In heat sterilization, which is similar in its lethal effect, there occur substantial changes in the aggregate state of the protoplast and some disturbances in the struc-

ture of the cells and of its organoids. As to functional changes, the rate of oxygen uptake and CO_2 liberation of the cells does not undergo any change upon incomplete radiation sterilization. The level of phosphorylation and incorporation of sulphur compounds in the proteins of the cell, although somewhat decreased, remains, however, fairly high. While the reproductive capacity is considerably reduced the growth function is preserved to a greater degree, and this results in the formation of hypertrophied cells. Upon incomplete heat sterilization, respiration and fermentation are greatly inhibited and still more so the adsorption of phosphorus and sulphur. The processes of phosphorylation and sulphur incorporation, at first greatly inhibited, undergo a partial recovery. Thermal treatment does not induce such a pronounced discrepancy between multiplication and growth as that caused by radiations. Radiation sterilization with large doses (1.5 mil. rep.) causes distinct structural and biochemical changes in the photoplast of the microbe cells, although less pronounced than in heat sterilization. Denaturation caused by heat sterilization is produced by a much greater release of phosphorus from the cells as well as of phosphoric compounds, sulphur and vitamins than in radiation sterilization. Upon radiation sterilization, even with very large doses, a certain biochemical activity and growth tendency of the microbe cells are preserved. This may prove important for sterilizing products with a dense microbe population. Direct destruction of the microörganisms and complete inactivation of their biochemical activity by ionizing radiations require doses of the order 4–5 mil. rep. For practical radiation sterilization of food products and pharmaceutical preparations with a moderate microörganism population, dose of the order of 1.5 to 2.0 mil. rep. will suffice. For "radiant pasteurization" and appreciable reduction of the microörganism count, doses one order smaller may be used. (auth)

7618

EFFECT OF NUCLEAR RADIATIONS ON PLANTS. P. A. Vlasyuk. p.127–48 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1–5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

The point of departure of this study of the effect of small doses of ionizing radiations of radioactive isotopes was that ionizing radiations are the natural composite part of the external medium in which the development of the plant takes place. Thus, small doses of ionizing radiations may be regarded as a factor with which the living organisms are genetically connected. It was shown by numerous laboratory, vegetation and field studies that the effect of ionizing radiations of radioactive isotopes on various physiological processes varies according to the nutritive conditions of the plants. The response of the plants to ionizing radiations consisted of two phases. In the initial stages it was accompanied either by excitation, as manifested in an abrupt increase in the physiological functions, or by an inhibition, viz., a reduction of the vital functions of tissues or cells. In the course of time the normal level of the physiological processes was recovered. The response of the plants to ionizing radiations depended on the conditions of the external medium. An increase in the functional mobility was noted in organisms treated with ionizing radiations. Preliminary treatment of the seeds with small doses of ionizing radiations or cultivation in a soil containing radioactive isotopes ensured a more complete utilization of the available nutrition, increased the metabolic rate and greatly increased the crop yield and the productivity of the plants. Preliminary treatment of the seeds may therefore be recommended for agricultural tests. Upon exposure of the plants to small doses of nuclear radiations a buffer system formed reducing as it were the harmful traumatizing action of the excess of radioactive isotopes. It appears fairly certain that in the defence functions of the organism a definite importance is attached to SH-compounds and to ascorbic acid. In view of the dissimilarity of the results obtained in studying the effect of nuclear radiations upon plants under different conditions of the medium, further inquiry into the mechanism of their biological action should be based on a precise knowledge of the nutritive conditions of the plant as well as of other factors of the medium. (auth)

7619

EFFECT OF NATURAL RADIOACTIVE SUBSTANCES ON THE YIELD OF AGRICULTURAL CROPS. N. G. Zhezhel. p.149–61 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1–5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

The principal results of experimental studies in the application of natural radioactive substances for increasing the yield of agricultural crops are presented. Tests have been made of substances containing the following radioactive elements: uranyl nitrate, radium in the form of radium chloride, and natural slate from the Leningrad Region with radioactive elements of the uranium, thorium and actinium series. Slate was used as the material which on obtaining positive results, might be widely applied for practical purposes without incurring great expenditures of money and labour. The properties of slate and its effect on plants were therefore taken up in greater detail. During a nine-year period 220 vegetation experiments in 8097 vessels, 317 field experiments on 10,000 plots and 182 production experiments on 1667.2 hectares were carried out. This work was done by 42 research institutions and 60 collective and state farms. The results obtained leave no doubt that the slate and small doses of radioactive elements may act as a powerful factor in increasing the yield of agricultural crops. Under definite conditions the radioactive elements not only increase the yield the same year they are introduced into the soil, but in subsequent years as well. That is to say, they exert a very appreciable positive effect and after-effect. Crop estimates over a period of eight years have shown a considerable rise in yield resulting from slate, radium and uranium introduced into the soil in 1947. The annual yield increments varied within fairly wide limits, yet on the eight-year average various doses of slate increased the crop by 20.95%, radium by 20.2%, and uranium by 32.0%. In the majority of cases the doses of 1×10^{-12} to 1×10^{-9} C per 1 kg of soil, proved most effective. It follows from the experimental data that the effect of natural radioactive substances may be positive and profitable from an economic point of view, provided optimal doses are used. The optimal doses should be established by taking into account a number of factors, of which the principal are the natural radioactivity of the soils in cooperation with the radioactivity created by potassium fertilizers, the biological peculiarities of the agricultural crops and of their varieties, the presence in the soil of a sufficient quantity of nitrogen as well as of phosphorus and of the microelements

indispensable to the plants, the kind and energy of radiation as well as the chemical properties of the element and its biochemical significance, and time and mode of administering the radioactive substances. Failure to observe these factors may become the principal cause of low efficiency of the radioactive substances or of their negative action on the development and productivity of the plants. (auth)

7620

IONIZING RADIATIONS AS A STIMULANT OF ERGOSTEROL BIOSYNTHESIS. R. D. Gal'tsova. p.162–72 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1–5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

The data presented lead to the conclusion that, along with other metabolic aspects, sterol metabolism belongs to the irradiation sensitive systems of the yeast cell. In fact, doses as low as 2500 to 5000r cause a distinct change in the ergosterol content of the metabolizing yeast cell. This difference in the ergosterol content in irradiated and non-irradiated cultures becomes apparent already after a 5 to 6 hour development. The greater the irradiation dose the greater the discrepancy in the ergosterol content between the irradiated and control yeast cultures. With doses of 90,000 to 100,000r, about 6% ergosterol accumulates in the irradiated cultures, while in the non-irradiated controls, the ergosterol content is by this time (4–5th day) only 2%. The above disturbances in the lipid metabolism are apparently associated with a disturbance in the normal course of the intermediate reactions of carbohydrate metabolism and of fatty acids as well. This is also evidenced by our preliminary data, viz., by pyruvic acid determinations whose content in the irradiated cultures is greatly decreased as compared with the control non-irradiated ones. In this respect the effect of ionizing radiations upon the yeast cells is quite specific, and the accumulation of ergosterol by the yeasts is observed only in this type of treatment. Ergosterol accumulation in the yeast cells is not caused by the other physical factors tested, such as temperature of ultraviolet irradiation. Hence the biosynthesis of ergosterol in the yeast cell can be stimulated either by irradiation itself or by concomitant reactions. (auth)

7621

BLOOD FORMATION AND IONIZING RADIATION. A. P. Egorov and V. V. Bochkarev. Moscow, Medgiz, 1955. (In Russian) (Book on display at Geneva Conference)

The collection opens with an exposition of certain data on the structure of matter and on characteristics of ionizing radiation. The major part of the monograph is devoted to the general laws of radiation effect on the blood system and to the morphological changes in blood cells. (publisher's note)

7622

PRINCIPLES OF THE BIOLOGICAL EFFECT OF RADIOACTIVITY. B. N. Tarusov. Moscow, Medgiz, 1955. (2nd edition) (In Russian) (Book on display at Geneva Conference)

General laws of ionizing radiation effect are dealt with. Mechanisms of primary action as well as those of secondary processes arising in biological objectives under irradiation are examined. The concluding chapter offers a brief summary on the toxicology of the radioisotopes which are biologically most active. (publisher's note)

7623

EFFECTS OF HIGH-ENERGY PARTICLES, X-RAYS, AND AGING ON LENS EPITHELIUM. L. von Sallmann, C. A. Tobias, H. O. Anger, C. Welch, S. F. Kimura, C. M. Munoz, and A. Drungis. Arch. Ophthalmol. 54, 489–514(1955) Oct.

Selective exposure of the equatorial and the central area of the lens epithelium of rabbits to a deuteron beam confirmed the impression of high radiosensitivity of cells in the germinative zone of the epithelium, in contrast to relative radioresistance of cells in the large central part. The effects of α particles, deuterons, and x rays on cell division and cell degeneration in the lens epithelium of young rabbits are compared, and the morphology of cell damage in the lens epithelium caused by the various radiations are compared with morphological changes caused by age. The relationship of radioinduced changes to the formation of radiation cataract is discussed. (C.H.)

7624

CHORIORETINITIS PRODUCED BY ATOMIC BOMB EXPLOSION. Jacques Landesberg (V. A. Regional Office, Brooklyn). Arch. Ophthalmol. 54, 539–40(1955) Oct.

The energy released from an atomic bomb blast has visible infrared and long ultraviolet rays, which are capable of producing thermal burns involving the choroid and retina. The pupillary diameter at the time of detonation is a very important factor. The pupillary and blink reflexes are too slow to prevent burning of the retina because sufficient energy for this arrives after the first 0.1 second. These reflexes take a longer time. The distance at which burns may be produced is much greater than that at which any other harmful effects of the atomic bomb occur, and at a given distance the burns on the retina are severer than those of the skin. This is true because of the optical system of the eye. It seems apparent that in this case the right eye did not receive the rays because of the shielding effect of the bony structures of the nose. It is concluded that the necessity of covering the eyes during an atomic blast is of the utmost importance. (auth)

7625

EFFECT OF PARENTERAL INJECTION OF PARTICULATE MATTER ON RESISTANCE OF X-IRRADIATED MICE TO INFECTION. Willie W. Smith, Falconer Smith, and Ilo M. Alderman (National Cancer Inst., Bethesda, Md.). Am. J. Physiol. 182, 400–2(1955) Aug.

In mice given a parenteral injection of particulate matter following midlethal irradiation, the increase in survival was largely accounted for by a reduction in the incidence of Proteus and E. coli infection, with no reduction in Pseudomonas infection. In mice injected with particulate matter following sublethal irradiation, resistance to Proteus or Pseudomonas challenge was increased 5 to 12 days after irradiation although granulocyte counts in tail blood were no higher than in parallel groups not injected with particulate matter. Both intraperitoneal and subcutaneous injections of particulate matter were effective against intraperitoneal, subcutaneous or intravenous challenge. The injection of glass particles increased survival to almost the same extent in mice immunized prior to irradiation and subsequently challenged with a two-fold concentration of Proteus culture as in mice not immunized and challenged with a 1:10 dilution of the culture. (auth)

7626

FUNCTIONAL STUDIES OF THE HYPERPLASTIC SPLEEN OF MICE RECOVERING FROM RADIATION DAMAGE. Willie W. Smith, Ilo M. Alderman, and H. Jeanette Ruth

(National Cancer Inst., Bethesda, Md.). Am. J. Physiol. 182, 403-6(1955) Aug.

Granulocyte counts were substantially higher in intact than in splenectomized mice 20 days, but not 15 days, after exposure to 600 r. Intact mice had a higher resistance than splenectomized mice to Pseudomonas challenge both 15 and 20 days after exposure to 600 r. This difference was greater than could be attributed to differences in preinfection granulocyte count and, allowing for granulocyte differences, it was essentially the same 15 days (spleen weight 64 mg) as 20 days (spleen weight 149 mg) after irradiation. Mice exposed to 475 r failed to mobilize granulocytes in response to a Pseudomonas injection 12 days after irradiation, but showed an increasing degree of mobilization at 14 and 16 days. The beneficial effect of homogenate of hyperplastic recovering spleens on lethally irradiated recipients was the same as that of homogenate of spleens from normal 2-week-old mice. (auth)

7627

ROLE OF HYPOTENSION IN THE INITIAL RESPONSE OF X-IRRADIATED CHICKS. S. P. Stearner, A. M. Brues, M. Sanderson, and E. J. Christian (Argonne National Lab., Lemont, Ill.). Am. J. Physiol. 182, 407-10(1955) Aug.

In young chicks, a severe hypotension developed during the initial postirradiation period after exposure to 1000 r x ray at 43 r/min. Birds that failed to survive the first 24 hours showed a small drop in blood pressure soon after exposure and a more drastic fall during the last half of the survival period. The early hypotension was not associated with any significant renal dysfunction, but complete anuria was seen as more severe hypotension developed. Shielding the kidney region during irradiation prevented direct damage to the kidneys, but did not prevent either severe hypotension or renal failure. On the other hand, local irradiation of the kidney region produced no effect on blood pressure, but frequently produced sufficient direct renal injury to result in a fatal uricemia. Effects of sustained hypotension produced by controlled hemorrhage indicated that the low arterial pressure during the last half of the postirradiation survival period was insufficient to maintain normal renal function. (auth)

7628

X-RAY BREEDING OF PEANUTS (ARACHIS HYPOGAEA L.). Walton C. Gregory (North Carolina State Coll., Raleigh). Argon. J. 47, 396-9(1955) Sept.

The amounts of genetic variation in a quantitative character, and yield of dried fruits, have been estimated in progenies of x-irradiated peanuts. The total genetic variance was measured in X_2 plant progenies in the X_3 generation and in terms of progeny to progeny differences. Each progeny was traced to an individual X_2 family. Each family was traced to a single seed which received the irradiation treatment. The estimates of genetic variation were made on normal plants only, one sample of which was randomly chosen from 384 different X_2 families. An additional sample consisting of 48 X_3 plant progenies was selected from normal but vegetatively vigorous mutants. The total genetic variance among the randomly chosen irradiated normals was four times that measured in control progenies. Several high yielding mutants were recovered from the populations studied. (auth)

7629

THE EFFECT OF 180-KEV AND 31-MEV X-RADIATION ON EHRLICH-ASCITES-CARCINOMA OF WHITE MICE. Kurt Reiche. Strahlentherapie 97, 549-67(1955) Aug. (In German)

Cellular structure, especially of mitosis, of the Ehrlich-Ascites-Carcinoma, without and after irradiation, the rhythm of mitosis after 500 r—min. after 5 h, max. after 24—48 h—and the effects of the dose—100—500 r—were analyzed, showing 31-Mev radiation less effective, however insignificantly. (auth)

7630

ON THE FREQUENCY OF THE RETARDATION OF SKELETON BY RADIATION TREATMENT OF HEMANGIOMA. Emil Fischer. Strahlentherapie 97, 599-607(1955) Aug. (In German)

The author re-examined 73 patients who, while still infants and babies, had received roentgen or radium irradiations for hemangioma of the extremities. In 14 of these patients, he observed a reduction in length of the irradiated portion of bone in the vicinity of the joint, in so far the hemangioma had embraced a large area of the respective part of the extremity. (auth)

7631

SEX-LINKED LETHAL MUTATIONS INDUCED BY THERMAL NEUTRONS IN MALE AND FEMALE DROSOPHILA MELANOGASTER. R. C. King and Eunice M. Wood (Brookhaven National Lab., Upton, N. Y.). Genetics 40, 490-9 (1955) July.

A study was made of the sex-linked lethal mutation rates induced in the germinal tissue of Drosophila melanogaster males and females by thermal neutrons. Nitrogen capture protons (which are primarily responsible for the biological effects of thermal neutrons in the fruit fly) are approximately 1.5 times as effective in producing sex-linked lethal mutations in sperm as are 90 kv X rays. Over the range of doses used the lethal mutation rate/dosage relation for X chromosomes of sperm appears to be linear. The mutation rate detected in viable eggs laid following treatment remains fairly constant for the first six days. Eggs laid 6–8 and 8–10 days following exposure have mutation rates 70% and 30% the original value. This original rate is only 75% the rate for sperm. The difference in the mutation rates induced in the male and female germ line may be due to a difference in mutability between sperm and egg chromosomes treated in late stages of gametogenesis or to differences in the nitrogen concentration between the male and female gonad. In the female germ line the lower frequency of mutations recovered from premeiotic and early meiotic stages than from late meiotic stages may mean that the mutation process occurs at a lower frequency in less mature cells or that a larger fraction of the potential lethal mutations are drawn off into inviable chromosome recombinations. Exposure of males and females to thermal neutrons also produces loss and fragmentation of X chromosomes in germ cells. (auth)

7632

AFTER-EFFECTS OF IONIZING RADIATION IN BARLEY. I. MODIFICATION BY STORAGE OF X-RAYED SEEDS IN OXYGEN AND NITROGEN. A PRELIMINARY REPORT. Jack D. Adams, R. A. Nilan, and Helga M. Gunthardt (State Coll. of Washington, Pullman). Northwest Sci. 29, 101-8(1955) Aug.

The data presented show that storage of dormant barley seeds after x radiation increases the amount of radiation damage as measured by frequency of chromosome bridges, seedling height, rate of germination, and emergence.

Furthermore, there is evidence that suggests oxygen enhances, while nitrogen retards, this storage effect. (auth)

7633

HISTOCHEMICAL STUDY OF THE ACTION OF X-RAYS ON CHOLINESTERASES. S. Hajdukovic. Experientia 11, 356-7(1955) Sept. (In French)

Using a histochemical method, the cholinesterase activity in mice after x irradiation was observed. Both types of cholinesterases were examined: AChE (specific ChE) of megacaryocytes of spleen and bone marrow, and AChE of motor endplates; and non-specific ChE of liver, pancreas, and prostate. There is no inactivation of AChE even after 5000 r. ChE is also very resistant. Activity is slowed down only 12 h or even a few days following irradiation and the inactivation remains slight. We suppose that the great alterations in cellular permeability caused by irradiation are not correlated with these enzymes. (auth)

7634

COMPARATIVE EFFECTIVENESS OF ROENTGEN RAYS OF 124 KV AND 50 MEV ON HABROBRACON EGGS TREATED IN FIRST MEIOTIC METAPHASE. Gertrude Heidenthal, Leonard B. Clark, and John W. Gowen. Am. J. Roentgenol. Radium Therapy Nuclear Med. 74, 677-85(1955) Oct.

First meiotic metaphase eggs of Habrobracon were used to test the comparative effectiveness of 124-kv and 50-Mev roentgen irradiations. Dosages ranged from 100 r to 1,750 r for low voltage, and from 100 r to 1,500 r for high voltage studies. Failure of unfertilized eggs to hatch has been attributed to the presence of dominant and, to a lesser extent, of recessive lethals. Dose action curves are approximately exponential. Test for difference between the slopes of the two curves when these were plotted and fitted on a semi-logarithmic scale revealed no statistically significant difference. Variance analysis of data within dose and for each voltage of radiation used showed that the data for each dosage appeared to be conveying the same information from experiment to experiment. Comparisons between 124-kv and 50-Mev data indicated that for a given dosage radiations of low and high voltage were revealing similar effects. A review of previous work by Whiting, on which the method was based, has led to the conclusion that roentgen irradiation has induced chromosome breakage, terminal deletions and the formation of chromosomal bridges in most of the eggs which died. Thus dominant lethals were mainly responsible for failure of eggs to hatch as larvae. (auth)

7635

THE EFFECT OF GAMMA RADIATION ON THE CENTRAL NERVOUS SYSTEM. II. THE EFFECTS OF LOCALIZED IRRADIATION FROM TANTALUM 182 IMPLANTS. Edgar A. Bering, Jr., Orville T. Bailey, Fred D. Fowler, Peter H. Dillard, and Franc D. Ingraham. Am. J. Roentgenol. Radium Therapy Nuclear Med. 74, 686-700(1955) Oct.

Localized irradiation of the central nervous system has been carried out using Ta^{182} as a source. This produces a gamma radiation of about 1.1-Mev energy at the rate of 6.1 r/mc/hr at 1 cm in air. The doses used have ranged from a few roentgens to several thousand roentgens. Complete irradiation data have been given so that the dosages can be converted to units other than roentgens if it is desirable. Gross and microscopic observations on a series of acute experiments on 18 monkeys are reported. The changes found were more extensive than could be accounted for by vascular damage alone, which suggests direct neuronal or glial effects. An attempt has been made to collect the observations of others on the effect of gamma and roentgen radiation on the central nervous system. However, because of the differences in methods of reporting dosage, this has been only partially successful. There were great differences between dosage effects from isotope gamma radiation and roentgen radiation, but there are not enough data to assess the importance of such factors as radiation energy and dose rate. (auth)

RADIATION HAZARDS AND PROTECTION

7636 NYO-4659

New York Operations Office. Health and Safety Lab., AEC RADIOACTIVE DEBRIS IN NORTH AMERICA FROM OPERATION TEAPOT. Daniel E. Lynch. Aug. 1955. 5p.

Fallout monitoring data for the United States and Canada during the spring of 1955 "Teapot" weapons test series are reported. In the continental United States individual station totals, extrapolated to January 1, 1956, range from 3.1 to 850 millicuries per square mile. Fallout in Canada and elsewhere is lower than in the United States. There are indications of continuing fallout in not greatly diminished amount for a short time after the close of the reporting period on May 20. (auth)

7637

A STUDY OF THE PROTECTION OF THE ANIMAL ORGANISM AGAINST THE DELETERIOUS EFFECT OF IONIZING RADIATIONS. E. Ya. Graevskii. p.34-50 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

The protective action against the radiation reaction of neurotropic substances, sulphydryl compounds and other reducing agents was tested on white mice irradiated with lethal doses of roentgen rays (minimum absolute lethal dose 700r). Some other substances were also tested which may presumably restore the normal state, compensate or stimulate the systems injured by irradiation. A prophylactic protective effect was obtained with carbon monoxide, carbon dioxide, heroin, morphine, adrenaline, and phenamine. A therapeutic protective action was produced by intravenous injections of homologous bone marrow and, to a lesser degree, by nuclear nucleoproteids, some alkaline and salt solutions. A histological study was carried out to establish the radiation damage and the nature of the protective action exercised by carbon monoxide as the effective protective agent and by the bone marrow emulsion which produced the most distinct therapeutic effect. In animals irradiated in an atmosphere containing carbon monoxide (volumetric concentration 0.5%) the destructive and degenerative phenomena in the radiosensitive organs (bone marrow, spleen, small intestine) develop somewhat later and are less pronounced than in control mice irradiated with the same dose. The reparation processes are commenced and completed at an appreciably earlier date, presumably owing to the greater nounced in such radiosensitive systems as the hemopoietic and digestive systems. Like the protective effect of most other prophylactic substances, the action of carbon monoxide is probably due to hypoxia created in the organism and may be explained on the basis of the indirect action of radia-

tion. Intravenous injection of the homologous bone marrow emulsion on the second day after irradiation, when the hemopoietic organs are extremely poor in cellular elements, results in an abrupt rise of the cell count in the bone marrow and the spleen, especially in its red pulp. Myeloid hemopoiesis is stimulated most of all while the condition of other systems of organs and tissues does not improve appreciably. A comparison of the histological pattern of the damage with the survival rate of the animals demonstrates that carbon monoxide, which reduces the damage of various systems of organs and tissues, greatly increases the survival rate of mice irradiated with a minimum lethal dose of roentgen rays, viz., 700r (up to 87%). Whereas, intravenous injection of the homologous bone marrow, which apparently directly affects only the hemopoietic system, increases the survival rate of the mice only up to 13.8% on the average. Hence, normalization of the hemopoietic system, alone does not produce any significant effect on the viability of the animals irradiated with absolutely lethal doses. Their survival rate can be increased only by protecting a series of vitally important systems, which actually seems to be accomplished by the use of carbon monoxide as a protective agent. (auth)

7638

SAFETY MEASURES IN HANDLING RADIOACTIVE ISOTOPES. S. M. Gorodinskiĭ and G. M. Parkhomenko. Moscow, Medgiz, 1955. (In Russian) (Book on display at Geneva Conference)

A popular pamphlet for persona working with radioactive isotopes. (publisher's note)

7639

SANITARY REGULATIONS AND INSTRUCTIONS FOR HANDLING RADIOACTIVE ISOTOPES. Moscow, Medgiz, 1955. (In Russian) (Book on display at Geneva Conference)

An official instruction approved by the State Sanitary Inspection of the USSR Ministry of Health. The rules provide the requirements for industrial premises and equipment of places for work with radioactive isotopes, instructions for intralaboratory transportation and storage, and an exposition of prophylactic measures for personnel. (publisher's note)

7640

EFFECT OF PARENTERAL INJECTIONS OF PARTICULATE MATTER ON SURVIVAL OF X-IRRADIATED ANIMALS. Falconer Smith, Willie W. Smith, Howard L. Andrews, and Marie M. Grenan (National Cancer Inst., Bethesda, Maryland). Am. J. Physiol. 182, 396-9(1955) Aug.

Experiments have been described showing that the intraperitoneal injection of suspensions of inorganic particulate matter including limestone, quartz, and Pyrex glass, given after irradiation, increase the survival of midlethally irradiated mice by about 22 animals/hundred. Comparable increases in survival were seen in irradiated guinea pigs and hamsters but were not seen in rats following glass treatment. Particulate matter could be varied in size from < 44 to 74 μ and in amount from 5 to 50 mg without loss of effect on survival in irradiated mice. The protective effect of the particulate matter on survival is thought to be due to an enhancement of defenses against the infection which follows midlethal irradiation. (auth)

7641

RESPONSE OF THE BLOOD CORPUSCLES IN HYPOPHYSECTOMIZED RATS TO IRRADIATION WITH X-RAY. B. L. Baker, E. C. Pliske, J. F. Kent, J. D. McGinty, J. G. Van Dyke, and F. H. Bethell (Univ. of Michigan Medical School, Ann Arbor). Endocrinology 57, 472-81(1955) Oct.

Three weeks after hypophysectomy, young adult female rats were given one dose (500 r) of total body x-irradiation. The ensuing depression in the erythrocyte and reticulocyte counts, hematocrit percentage and hemoglobin concentration was more severe than in the non-hypophysectomized, irradiated rats. During the 11-week period of observation, the erythrocyte count and hemoglobin concentration in hypophysectomized-irradiated rats returned toward the level of that shown by the non-irradiated hypophysectomized rats. The reticulocyte count and hematocrit percentage equalled or surpassed the values for the latter group. Macrocytosis resulted from irradiation in only the hypophysectomized rats. The total leucocyte count fell to the same level in both hypophysectomized and non-hypophysectomized rats but showed greater recovery in the hypophysectomized-irradiated animals. It was concluded that the capacity of the blood-forming tissues to recover from the damaging effects of x-irradiation is not completely dependent on the action of pituitary hormones. (auth)

RADIOTHERAPY

7642 UCRL-3035

California. Univ., Berkeley. Radiation Lab.

RADIATION HYPOPHYSECTOMY WITH HIGH-ENERGY PROTON BEAMS. Preliminary Report. Cornelius A. Tobias, J. E. Roberts, J. H. Lawrence, B. V. A. Low-Beer, H. O. Anger, J. L. Born, R. McCombs, and Charles Huggins. July 1955. 50p. Contract W-7405-eng-48.

Initial use of high-energy 340-Mev protons in a human therapeutic investigation is reported. Localized irradiation of the human pituitary gland was achieved by a combination of multiple-port and rotational application of the high-energy particles. This procedure allows accurate delivery of high doses to the pituitary gland, with much lower doses to surrounding bone, brain, nerves, and skin. The patients were advanced cases of metastatic carcinoma of the breast, who had previous mastectomy, x-ray therapy, hormone administration, oophorectomy, and adrenalectomy. Definite evidence of depression in pituitary hormone output and control of target organs was achieved with peak doses of 14,000 to 30,000 rad at the center of the pituitary. The effects were delayed and gradual in their onset. Undesirable side effects were absent. So far only 9 months' experience on 12 patients is available. Full evaluation of the pituitary-ablation and cancer-therapeutic effectiveness will have to be made at a later time. (auth)

7643

PROVISIONAL SANITARY REGULATIONS FOR ARRANGING AND EQUIPPING GTU-Co-400 AND GTU-Co-20 GAMMA THERAPY CLINICS. Moscow, Medgiz, 1955. (In Russian) (Book on display at Geneva Conference)

An official document approved by the State Sanitary Inspection of the USSR Ministry of Health. It contains the requirements for laboratories to be equipped with Co^{60} gamma therapy units, activity 20 or 400 g-equiv. of radium, and the measures for the protection of the medical staff against gamma irradiation. (publisher's note)

7644

RADIOACTIVE COBALT THERAPY. M. N. Pobedinskiĭ and A. M. Strelin, eds. Moscow, Medgiz, 1955. (In Russian) (Book on display at Geneva Conference)

A collection of reports on problems of biological effect and medical application of Co^{60} in various diseases (cancer tumours of different organs, lymphogranulomatosis, tuberculous lymphadenite, acromegaly, etc.), delivered at the Conference in Leningrad in 1952. The collection offers data on the physical characteristics of Co^{60} and on the design of gamma apparatus and shielding devices. (publisher's note)

7645

RADIOACTIVE PHOSPHORUS TREATMENT OF ERYTHREMIA AND LEUCOSIS. A. N. Kiselev and M. N. Pobedinskiĭ, eds. Moscow, Medgiz, 1955. (In Russian) (Book on display at Geneva Conference)

A collection of reports delivered at the Conference held in Leningrad in 1953. (publisher's note)

7646

THE USE OF RADIOACTIVE PHOSPHORUS IN THE TREATMENT OF SKIN DISEASES. M. N. Pobedinskiĭ, Kozhevnikov, and A. N. Kiselev, eds. Moscow, Medgiz, 1955. (In Russian) (Book on display at Geneva Conference)

A collection of reports presented at the Conference held in Leningrad in 1953. Most of the papers are devoted to the medical application of P^{32} in angiomas, neurodermatitises, eczemas, and other skin diseases. The physical properties and dosimetric characters of P^{32} are likewise exposed. (publisher's note)

7647

STUDIES ON THE USE OF RADIOACTIVE ISOTOPES IN MEDICINE. A. Ignatyev, ed. Moscow, Medgiz, 1955. (2nd edition) (In Russian) (Book on display at Geneva Conference)

The symposium comprises 28 papers on the use of radioactive isotopes in blood diseases therapy; in determining the functional state of the thyroid gland; in microbiological, immunological, and virological investigations, in physiology, biochemistry, and toxicology. The book includes also a review on radiometry. (publisher's note)

7648

THE USE OF RADIOISOTOPES IN MEDICINE. Heinz Heuwieser. Strahlentherapie 97, 621-32(1955) Aug. (In German)

A report is presented on a series of conferences organized in Hamburg by the Norddeutsche Röntgengesellschaft from October 18 to 22, 1954, on the subject, "The Use of Radioisotopes in Medicine". (auth)

7649

THE USE OF RADIOACTIVE GOLD IN THE TREATMENT OF EFFUSION DUE TO CARCINOMATOSIS OF THE PLEURA AND PERITONEUM. Morton M. Kligerman and David V. Habif (Columbia Univ. Coll. of Physicians and Surgeons and Presbyterian Hospital, New York). Am. J. Roentgenol. Radium Therapy Nuclear Med. 74, 651-6(1955) Oct.

As a result of the observations on thirty-five patients, it is concluded that the use of radioactive gold in the treatment of carcinomatosis of the pleural and peritoneal surfaces is purely a palliative procedure directed against the repeated formation of fluid. For this particular purpose in the management of the advanced cancer patient, however, radioactive gold has proved to be of value in over half of the patients who survived one month or longer. It is our impression that for this limited purpose it is superior to the use of external irradiation. Not only are a larger number of patients benefited, but it is easier to administer and the overall morbidity is decreased. It is important to reiterate that radioactive gold cannot be depended upon to decrease the size of abdominal masses. Should abdominal masses be present, especially in the case of ovarian carcinoma, external irradiation should have a fair trial before the patient is given radioactive gold. While it is true that radioactive gold cannot be expected to reduce the size of tumor masses, this does not mean that the annoyance of repeated fluid accumulation cannot be prevented in cases in which tumor masses are also present along with fluid in the abdomen. Before radioactive gold is used, an estimation of the rapidity with which the fluid reforms should be made, especially in advanced cases in relatively poor physical condition. The use of gold is not warranted if a thoracentesis or paracentesis is not required more frequently than once every month. $Gold^{198}$ failed to control the return of ascites in two patients in whom fluid collection was not due to carcinomatous serosal implantation. (auth)

7650

TREATMENT OF MALIGNANT SEROUS EFFUSIONS WITH RADIOACTIVE COLLOIDAL CHROMIC PHOSPHATE. Henry L. Jaffe (Cedars of Lebanon Hospital, Los Angeles). Am. J. Roentgenol. Radium Therapy Nuclear Med. 74, 657-66(1955) Oct.

Radioactive colloidal chromic phosphate is a useful palliative agent in therapy for patients with metastatic carcinoma; it is equally as effective as radiogold and more convenient for use in the clinic and operating room. (auth)

7651

RADIOTHERAPY OF BLADDER CANCER BY MEANS OF RUBBER BALLOONS FILLED IN SITU WITH SOLUTIONS OF A RADIOACTIVE ISOTOPE (Co^{60}). J. H. Muller (Univ. of Zurich, Switzerland). Cancer 8, 1035-43(1955) Sept.-Oct.

7652

STUDIES ON THE DISTRIBUTION OF RADIOACTIVE COLLOIDAL GOLD IN REGIONAL LYMPH NODES CONTAINING CANCER. William B. Seaman and William E. Powers (Washington Univ. School of Medicine, St. Louis). Cancer 8, 1044-6(1955) Sept.-Oct.

Studies were made on patients with breast cancer to determine the distribution of radioactive colloidal gold in the axillary lymph-node metastases. Radioactivity was found in only twenty of sixty-four cancer-containing lymph nodes. The radioactive gold is found in the residual normal lymphoid tissue as shown by histological and radioautographic methods. Lymph nodes completely replaced by tumor did not pick up any radioactive gold. The interstitial injection of radioactive gold is not a reliable method of irradiating regional lymph-node metastases. (auth)

TRACER APPLICATIONS

7653 UCRL-2941

California. Univ., Berkeley. Radiation Lab. CONTINUOUS $C^{14}O_2$ AND CO_2 EXCRETION STUDIES IN EXPERIMENTAL ANIMALS. B. M. Tolbert, Martha Kirk, and E. M. Baker. Aug. 10, 1955. 22p. Contract W-7405-eng-48.

An apparatus has been devised which permits, after administration of labeled compounds to animals, the continuous measurement and recording of CO_2 excretion by means of infrared absorption, C^{14} excretion by ion chamber chambers, and specific activity by a ratio analyzer. Com-

parative excretion studies have been made using labeled amino acids, fats, fatty acids, and sugars. The specific activity and total activity rate curves for breath carbon-14 are markedly different. The generally smooth nature of the specific activity curves gives an excellent indication of the continuous and steady processes by which radioactivity is distributed into the various body pools. Studies have been made with mice, rats, guinea pigs, and rabbits. As small an amount as 0.1 μc C^{14} has been used for an 8-hour study in mice. The instrument can be readily adapted for use in large animal or human studies following administration of small amounts of C^{14}. (auth)

7654 UCRL-3066

California. Univ., Berkeley. Radiation Lab.
THE METABOLISM OF THE LANTHANONS IN THE RAT. Patricia W. Durbin, Marilyn H. Williams, Margaret Gee, Ruth N. Newman, and Joseph G. Hamilton. July 1955. 41p. Contract W-7405-eng-48.

The metabolism of the lanthanons has been studied in the rat on a systematic basis using tracer techniques. High-specific-activity preparations were administered orally or intramuscularly as citrate complexes. Data are presented for the 15 lanthanons one and four days after administration, and at intervals up to eight months for those isotopes with sufficiently long half-lives. In general, absorption from the parenteral injection site was relatively complete at four days. Gastrointestinal absorption of the four lanthanons administered orally was insignificant. (auth)

7655

THE USE OF ISOTOPES IN BIOCHEMISTRY, ITS ACHIEVEMENTS AND PROSPECTS. V. A. Engel'gardt. p.80-106 in Plenary Meeting. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 106p. (In Russian)

7656

THE USE OF C^{14} AND P^{32} IN THE STUDY OF THE SYNTHETIC FUNCTIONS OF ISOLATED CHLOROPLASTS. N. M. Sisakyan. p.172-83 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

P^{32} and C^{14} were used for studying the synthetic functions of isolated chloroplasts. Some general conclusions were drawn from the experimental data obtained. In the light of these data, the former concepts on the role of chloroplasts in the vital activity of plants seem to be somewhat incomplete. There is no doubt at present that the chloroplasts not only participate in the assimilation of CO_2 by green plants, but also play an exceptionally important part in various biochemical transformations in the cell. The manifold biochemical functions of the plastids are due to the presence of polyvalent enzymic systems in them. In the chloroplasts, synthesis and oxidation of fatty acids and incorporation of phosphorus in phospholipids take place. It is possible to show under certain experimental conditions that labelled glycine-C^{14} and glycil-glycine-C^{14} are incorporated in the proteins of the chloroplasts. The rate of incorporation of these substances depends both on the nature of the compound at issue and on the physiological condition on the chloroplasts. Thus, all the experimental data and observations make it possible to consider that chloroplasts play a very important part in the biochemical functions of the plant cell. (auth)

7657

C^{14} IN THE STUDY OF PRIMARY PHOTOSYNTHETIC PRODUCTS. E. A. Boichenko and N. L. Zakharova. p. 184-97 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

A parellel study of primary photosynthetic products was carried out in the leaves of Primula obconica and in their isolated chloroplasts. The results obtained are at variance with some recent concepts reported in published works, according to which phosphoglyceric acid and low molecular substances related to it are the primary products of photosynthesis. These discrepancies are due to the difference in the technique used for isolating fractions after the experiments with $C^{14}O_2$. To prevent distintegration of the chloroplasts, they were isolated from the leaves in an isosmotic sucrose solution at 1 to 3°C and by subsequent partition through centrifugation. In this way three fractions were obtained, viz., intact chloroplasts, substances precipitable after the isolation of plastids with 60% acetone, and those remaining in the solution. Phosphoglyceric acid belongs to the last category. The amount of labeled carbon dioxide assimilated by various fractions was calculated in mg per 100 mg dry weight of the chloroplasts. In the light its assimilation in the leaves begins in the acetone precipitable substances. Then C^{14} is detected in the chloroplasts and last of all in the soluble substances. With 0.004% $C^{14}O_2$ this can be noted within a 6-second photosynthesis, and when the latter is slowed up, by means of enzymic poison-hydroxylamine at more lengthy exposures. It is possible to obtain more than 0.1 mg of assimilated labelled carbon dioxide even without any traces of radioactivity in the dissolved fraction. With 0.08% $C^{14}O_2$ and more, a general inhibition of photosynthesis is noted in the 1 and 10 min. experiments. The initial assimilation is accelerated, and hence the application of such high concentrations with a small exposure time is meaningless. C^{14} being detected upon a 6-second exposure in all fractions, most of all in the dissolved substances. This, however, is no evidence of their primary formation as in no case was it possible to note C^{14} transfer from carbon dioxide obviating other fractions. Thus, phosphoglyceric acid is not the primary photosynthetic product. The presence of the primary carbon dioxide acceptors in the substances of the acetone precipitate was confirmed by experiments on isolated chloroplasts. When these fractions were combined in vitro $C^{14}O_2$ assimilation in 30 minutes was as high as in the leaves prior to C^{14} transition into the solution (0.05-0.1 mg). The primary products can be isolated by boiling in water and precipitating with barium salts in 80% ethyl alcohol. They resemble the polyhydroxyacids described in experiments with C^{11}. By means of hydrolysis some substances can be released from them which give the Tollens reaction with naphthoresorcine. It is precisely this kind of decomposition that prolonged boiling produces. Part of the substances passes into the solution and this leads to the erroneous conclusion that such low molecular substances are the primary products of photosynthesis. The substance remaining in the precipitate after hydrolysis is neither protein nor carbohydrate. It is the long since sought after primary carbon dioxide acceptor and contains about 1% iron. Upon addition of

$C^{14}O_2$, there occur some changes in the state of the iron of the acceptor. This is an increase in the percent of iron which cannot be detected immediately after incineration by the thiocyanide method, but only after repetitive oxidation of the ash by perhydrol. Observations on the changes undergone by the different forms of iron in photosynthesis as well as enzymic poison tests show that the assimilation of carbon dioxide begins with its addition to the iron of the molecule of the acceptor. (auth)

7658

DISTRIBUTION OF CARBON AMONG ORGANIC SUBSTANCES FORMED WITH THE AID OF PHOTOSYNTHESIS. O. V. Zalenskii. p.198–220 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1–5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

It was found that after a 10 to 40 minute photosynthesis in a $C^{14}O_2$ atmosphere, labelled carbon could be detected in plants that had been kept in ordinary conditions for at least two weeks. Several hours after photosynthesis in $C^{14}O_2$, the barley plant loses about $\frac{1}{3}$ of the total assimilated carbon and subsequently its content diminishes but very slowly. This is accounted for by the co-occurrence of two opposite processes which determine the expenditure of carbon consumed in photosynthesis. An accelerated expenditure of carbon of the products newly formed in the photosynthesis may account for the correlation existing between the rate of this process and the amount of organic substance accumulated in the plant. Translocation of organic substances containing labelled carbon from the leaves to the roots of the plant likewise proceeds at the highest rate during the first hours following photosynthesis. The reduced night temperature (0°) at which the plants had been cultivated prior to the experiment activates the flux of assimilates formed in photosynthesis. Moreover, the after-effect of low night temperature greatly inhibits the accumulation of carbon absorbed by photosynthesis in the lipids, complex proteins and cellulose of the leaves, and increases its content in the complex proteins of the roots. These data testify to the close connection between photosynthesis and the physiological processes in the root system as noted by D. A. Sabinin and A. L. Kursanov. The evidence shows that the distribution of carbon in the organic compounds formed in photosynthesis depends on the length and the conditions accompanying this process. Hence, the concept of photosynthetic products should by itself imply the above parameters. It was shown in experiments on various plant species of the high altitude deserts of the Pamirs that, in the morning hours and in summer when the leaves are younger, carbon taken up in photosynthesis is utilized in large amounts for the formation of organic compounds which cannot be extracted with alcohol and do not belong to the soluble sugars. The quantitative distribution among organic compounds of the carbon consumed in photosynthesis varies from species to species. Still, the composition of the sugars as well as of the organic acids in the four species tested is quite uniform, in spite of the fact that these species are absolutely different both with regard to their taxonomic position and ecological-physiological characters. It follows from this, that at least the quantitative role of photosynthesis in the formation of organic substances is far from uniform in different plants as well as under different conditions of physiological activity. (auth)

7659

THE USE OF RADIOACTIVE ISOTOPES IN STUDIES OF PLANT FERTILIZATION. I. M. Polyakov. p.221–33 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1–5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

In 1953–1954, a method was developed by the writer in collaboration with A. N. Dmitrieva for studying the fertilization process in higher plants by means of radioactive isotopes. Pollination was performed at different times in several tobacco species, viz., Nicotiana tabacum, N. rustica and N. affinis as well as in maize (Zea mays), etc. At first pollination was carried out with pollen not treated with radioactive isotopes, and then repetitive pollination was performed at different periods with S^{35} and P^{32} labelled pollen (yielding 100 to 500 impulses per mg per min). Repetitive pollination was planned in such a way that the labelled pollen tubes would attain the ovary only after fertilization with non-tagged pollen was completed in all the ovules or embryonic development had already commenced. An examination of the seeds for their S^{35} and P^{32} content showed that the pollen of the repetitive pollinations contributes its own "radioisotope material" to the metabolic processes of the already developing seeds (the embryos and endosperm). The amount of this material changes in a regular way in accordance with the periods of repetitive pollinations. This is primarily the physiological "multiple effect" of fertilization. Simultaneous microscopic control was carried out on the viability of the pollen and of the growth of the pollen tubes in the pistils as well as genetic control. A considerable rise of viability was noted in the progeny developing from the seeds obtained from repetitive pollinations. The quantitative aspect of these processes can be characterized in the following way. The following indices should be known: number of pulses per 1 mg pollen tagged with S^{35} or P^{32}, number of pollen grains per 1 mg, number of pulses per 1 gr seeds, number of seeds per 1 gr. In this way it is possible to compute the number of pollen tubes from which S^{35} and P^{32} are conveyed to one ovule. In our experiments the respective figures vary from 2.2 to 3.4. These are preliminary data, since the final result varies in different species and under different conditions, and also depends on the amount of radioisotope material consumed in the metabolic processes by growing pollen tubes in the tissues of the pistil. It was also shown that with pollen mixtures consisting of non-tagged pollen of the given species and tagged pollen of another species which cannot directly participate in fertilization, a certain amount of S^{35} or P^{32} can be detected in the seeds. It may be assumed that the radioactive isotopes arise out of the physiological interactions between the components of the pollen mixtures. (auth)

7660

A STUDY OF NITROGEN NUTRITION AND NITROGEN METABOLISM IN PLANTS BY MEANS OF THE N^{15} ISOTOPE. F. V. Turchin, M. A. Guminskaya, and E. G. Plyshevskaya. p.234–53 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1–5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

The following are the conclusions made from a study of

the isotope content of various nitrogen fractions (non-protein organic nitrogen of amino acids, insoluble proteins of tissues, constitutional, soluble storage proteins, chlorophyll) along with a quantitative estimate of their content in the plants being exposed for different times on media containing ammonium sulfate traced with N^{15}. In plants, incessant renewal of protein keeps taking place. This process goes on at a very high rate in the aerial organs (leaves) of young plants in which the total nitrogen of the constitutional proteins is practically completely renewed in the course of 90 to 100 hours. The storage soluble proteins of the green parts of the plants are renewed at a lower rate than the constitutional proteins. Labelled nitrogen is detected in the latter at earlier dates than in the storage proteins; hence it may be considered that primary protein synthesis begins with the formation of constitutional proteins. The renewal of storage and of constitutional proteins in the roots of plants (the exposure time on N^{15} is longer, amounting to 12 to 72 hours) proceeds at a much lower rate than in the leaves. The data obtained show that the inorganic nitrogen absorbed by the plant is very rapidly transformed in the roots into amino acids. At any rate, as quickly as 15 minutes after the application of tagged ammonium sulfate, it is possible to detect considerable amounts of newly-synthesized tagged amino acids. The tagged nitrogen added was detected in considerable amounts in amino acids of the leaves after four hours and in the protein and chlorophyll after six hours. After application of tagged ammonium sulfate the content of mobile storage proteins in the roots greatly increased due to their migration from the leaves. It will be noted that the transformation of inorganic nitrogen in the roots into amino acids is accomplished with the aid of storage proteins as carriers of the respective enzymatic systems, catalysing amino acid synthesis in the plants. With an increased supply of inorganic nitrogen the content of these proteins in the roots becomes insufficient, and this shortage is compensated by the migration of storage proteins from the leaves to the roots. The lighting conditions play an important part in the nitrogen nutrition and metabolism of plants. Even in the case of a short exposure of the plants to darkness (6 hours), the nitrogen absorption greatly diminishes; the rate of amino acid synthesis greatly decreases as well. The synthesis and renewal rate of proteins likewise falls sharply in the dark. Nitrogen of the pyrrole nucleus of the chlorophylls is constantly renewed. The rate of renewal of the chlorophyll nitrogen is very high. In our experiments the chlorophyll nitrogen was completely renewed, practically, in 90 to 100 hours. (auth)

7661

PHYSIOLOGY OF OILPLANT FRUITS STUDIED BY MEANS OF C^{14}. V. E. Pontovich. p.254–69 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1–5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

One of the most important factors affecting the direction of the synthetic processes in plant tissues is the gas regime mainly determined by the oxygen and carbon dioxide content. However, while there are numerous data regarding juicy fruits, no indications will be found regarding the gas regime of oilplant fruits. Yet, a study of the gas regime is indispensable for the comprehension of the regularities underlying the formation and accumulation of oil in the seeds of oil plants. A study carried out on Papavar somniferum showed that the different parts of the boll have an individual gas regime. The intercellular spaces of the placenta contain much (11 to 12%) carbon dioxide and relatively little (9 to 10%) oxygen. In the central cavity of the boll where the seeds are formed, the carbon dioxide content is low (up to 1%) and that of oxygen high (18 to 19%). The peculiarities of the anatomical structure of the boll ensure an intense gas exchange between the central cavity of the boll and the external atmosphere. Gas exchange between the central cavity and the placental intercellular spaces is impeded. Thus, the transformation of substances in the seeds and placenta proceeds under different conditions of the gaseous regime. In fact, the formation of the seeds and the accumulation of reserve products in them proceed under favourable conditions of oxygen supply, while transformation of the substances in the placenta occurs in an atmosphere with a reduced oxygen supply and increased carbon dioxide content. It proved possible to establish by means of $C^{14}O_2$ that both in the light and in the dark, carbon dioxide emitted into the cavity by the seeds is conveyed to the wall of the boll where it is assimilated and translocated in the form of organic products to the placenta and therefrom to the seeds. Later on labelled carbon is to be detected again as CO_2 in the central cavity of the boll as a result of respiration of the seeds. In this way the regulation of the gas regime is accomplished inside all the tissues and the cavity of the fruit. Thereby aeration conditions are secured in the boll which are necessary for the normal synthetic processes in the seeds. The appearance of labelled carbon dioxide in the placental intercellular spaces is a result of its being split off from the products transferred to the placenta from the wall of the boll or from the leaf (provided labelled carbon dioxide had been administered to the leaf). The distribution of C^{14} among the tissues of the boll is different in the light and in the dark. Upon normal illumination of the boll, maximum activity was found in the wall of the boll, a lesser activity in the placenta, and still less in the seeds. The placenta tissues are most active in the dark. It was found that irrespective of illumination C^{14} is detected after one hour exposure in the organic acids, sugars, amino acids, and fat. When carbon dioxide is administered in the light, the activity of the above substances is much greater than in the dark. It will thus appear that photosynthesis in fruit is an important prerequisite for the maintenance of the gas regime on a definite level which is important both for the development of the fruit and of the seeds. (auth)

7662

C^{14} IN THE STUDY OF THE METABOLIC RATE IN YEAST AND LACTIC ACID BACTERIA. I. Ya. Veselov, V. M. Levacheva, and E. G. Frolova. p.270–88 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1–5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

A study was carried out of the incorporation of C^{14}-glucose, C^{14}-acetaldehyde, and C^{14}-acetic acid in the biomass of yeast, and of C^{14}-glucose and C^{14} yeast autolysate in the biomass of B. Delbrückii in the course of fermentation. Radioactive carbon was shown to be firmly incorporated in the yeast biomass. During the period of main fermentation, when the glucose is being actively fermented and the multiplication of the yeast is going on, no release of the radioactive label into the

medium is noted. The release of radioactive substances from the biomass begins during the extinction phase of fermentation when conditions are created for the dominance of the dissimilation processes which presumably result in partial autolysis of the biomass of the yeast cells. Upon fermentation of labelled glucose by B. Delbrückii, the fermentation products of labelled carbohydrates are incorporated in the forming biomass, and in this way the nitrogen containing compounds become carbon tagged. When non-labelled glucose is fermented by B. Delbrückii in the presence of labelled nitrogeneous compounds, the relative activity of the nitrogeneous compounds of the biomass is less than those of the medium. Obviously, the latter are reconstructed into the nitrogeneous compounds of the bacterial biomass at the expense of the intermediate fermentation products of carbohydrates. The experimental evidence suggests that the biological role of the carbohydrate fermentation of yeast and lactic acid bacteria consists in the formation of such intermediate products of glucose breakdown which, by virtue of their composition and energy potential, are able to maintain the metabolism and are utilized for a synthesis of the biomass of the microorganisms multiplying under anaerobic conditions. (auth)

7663

THE STUDY OF THE BIOCHEMICAL BASIS OF NERVE EXCITATION AND INHIBITION BY MEANS OF THE RADIOACTIVE ISOTOPE METHOD. Kh. S. Koshtoyants, T. M. Turpaev, and D. E. Ryvkina. p. 289–304 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1–5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

The nature of nervous excitation and inhibition is one of the most urgent problems of modern physiology and medicine. Since O. Loewi's (1921) discovery of active substances, now universally known as chemical mediators of the nerve impulse, which participate in the processes of nerve excitation and inhibition, their formation and mode of action have been the object of study in most of the physiological laboratories of the world. Principal attention is here due to the enzyme system "acetylcholine-cholinesterase" which plays the most important part in the biochemistry of the nervous system. It has been pointed out by Koshtoyants in his reports presented to the International Physiological Congresses of 1947, 1950 and 1953 that a particular role in the activity of the nervous system and of its chemical mediators is played by the so-called reactive or functional groups of proteins, in particular by the sulphydryl groups. The blockade of the tissue SH groups by $HgCl_2$ deprives the frog heart of its susceptibility to vagal impulses and to the respective mediator, vizi-acetylcholine, whereas cysteine restores the disturbed function (Ch. S. Koshtoyants, T. M. Turpaev, 1946). The $Hg^{203}Cl_2$ experiments showed that the disturbance in cardiac susceptibility of the frog to acetylcholine is caused by a blockade of only 1.3 to 2.0% of free SH groups of the cardiac muscle. Upon simultaneous exposure of the ventricle to acetylcholine (choline, carbocholine) and to $Hg^{203}Cl_2$ a competitive relationship between both substances is observed. In fact, acetylcholine (choline, carbocholine) prevents the reaction of Hg^{203}-ions with the tissue structures and decreases the rate of Hg^{203} accumulation by the cardiac muscle. It appears that an important part in the interaction of acetylcholine with susceptible structures is played by the reaction between the choline part of the acetylcholine molecule and the SH groups of proteins (T. M. Turpaev, 1955). Owing to the extremely great therapeutic importance of thiol compounds in a number of clinical cases, radiation disease inclusive, further inquiry along these lines may not only provide a deeper insight into the fine structural and and chemical positions in nerve excitation and inhibition but also contribute to the solution of some important problems of practical medicine. A study is being carried out on another aspect of the chemical basis of nerve regulation, i. e., on histamine. The effect of histamine on some functional properties of the nerve tissue has been studied particularly with regard to phosphorus metabolism of the peripheral nerves. It was found that along with an acceleration of the oxidative processes histamine stimulates the incorporation of P^{32} in the orthophosphate and phosphoprotein fractions (D. E. Ryvkina). This fact offers a deeper insight into the as yet obscure mechanism of biochemical action of histamine as one of the "mediators" of the nerve impulse and as a participant of a number of physiological and pathological processes. (auth)

7664

CARBOHYDRATE METABOLISM IN THE ANIMAL ORGANISM AS STUDIED BY MEANS OF RADIOACTIVE C^{14}. B. N. Stepanenko. p.305–19 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1–5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

Administration of $NaHC^{14}O_3$ and of definite adrenaline doses to fasting animals is followed by an increase in the glycogen content of the liver as well as by an appreciable incorporation of C^{14} in the glycogen molecule. A procedure has been developed which makes possible the preparative production of radioactive glycogen and glucose using the above adrenaline effect. Radioactivity estimates of different carbon atoms of the radioactive glucose synthesized upon administration of adrenaline showed the label to be in the positions 3 and 4. Administration of adrenaline, stimulating a synthesis of the carbon chain (incorporating C^{14}) of the glucose radicals in the livers of healthy fasting animals, produces slight or no effects in diabetic animals. This is a new characteristic feature of diabetes as a pathological phenomenon. A study of the metabolic rate of different parts of the glycogen molecule showed that in the central widely branching parts of the molecule it proceeds at a much lower rate than in the peripheral branches. This contributes to the comprehension of the biological significance of the peculiar chemical structure of glycogen. (auth)

7665

THE MECHANISM OF CAROTENOID ACTION. CAROTENOIDS AND SULPHUR METABOLISM. S. D. Balakhovskii and I. V. Kuzentsova. p.320–37 in Meetings of the Division of Biological Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1–5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

The functions of the carotenoid polyenes within the organism are extremely manifold as is evidenced by empirical observations of avitaminosis phenomena. It was shown in our laboratory by physiological as well as in vitro experiments that some carotenoid polyenes and their oxidation products exhibit, upon local application, anti-inflammatory, anti-spasmatic, anti-allergic and epithelizing properties as well as a peculiar local analgesizing action without affecting

the tactile or other kinds of tissue sensitivity. A study of the interaction of these substances with acetylcholine and histamine mediators (on a piece of small intestine of a guinea pig) showed that some polyenes possess a distinct and others a very considerable anti-mediator activity. This may account for the above pharmacological and physiological properties of the carotenoid polyenes. The mechanism of the analgene activity of the carotenoids might have been attributed to the inhibition of histamine action which, according to published data, has an anti-dehydrogenase activity. A study of the redox properties of the carotenoids (on indigo carmine as substrate) shows that these substances are oxygen carriers like oxidases and peroxidases (in vitro) although much less active than the latter. Linkage to a non-specific protein increases the activation of the molecular and peroxide oxygen. The keratinization process at its latest stage is determined by the formation of S—S-linkages at the expense of the thiol groups. This is evidenced by Marstone's histochemical data. In published material, it is found that in avitaminosis no appreciable changes occur in the sulphur content of various tissues and organs. We have shown that upon administration of S^{35} labelled methionine the activity is disturbed among the brain, muscles, skin, intestines and lungs more or less similarly in normal and avitaminotic animals. It is increased above the norm in the liver, kidneys, blood, and sexual organs. Whereas, when the blood activity is taken as a unit, the ratio of activity of the avitaminotic tissue to that of normal tissue will exceed the unit only in the liver and kidneys. However, the difference between the liver and kidneys is levelled in both groups of animals on the 5th day after the administration of methionine, and no accumulations of radioactive sulphur are formed. It will appear therefore that keratinization is not due to the formation of new proteins enriched in sulphur, but to the removal of some kind of inhibition which affects the last stage of keratinization, viz., the formation of S—S-linkages at the expense of the SH groups of proteins. The connection of carotenoids with the matabolism of sulphur-containing amino acids is likewise evidenced by the results obtained in a study of the effect produced by carotenoids on the " incorporation" of methionine in the hepatic tissue. These experiments showed that incorporation of methionine is inhibited by carotene and retinene and that upon retinene treatment the inhibition is much more pronounced in the liver sections of anavitaminotic rat than in those of a normal rat (28.5% versus 19%). (auth)

7666

LABELLED ATOMS IN AGRICULTURAL RESEARCH. A. M. Kuzin. Moscow, Akademiya Nauk S.S.S.R., 1954. 103p. (In Russian) (Book on display at Geneva Conference)

Utilization of radioactive and stable isotopes in investigating nutrition and plant metabolism, in studying vegetative hybridization as well as soil processes. Application of labelled atoms in studying animal metabolism and in elaborating methods for eradicating agricultural pests. Devices for recording labelled atoms are described. (publisher's note)

7667

LABELLED ATOMS IN ELABORATING THE SCIENTIFIC PRINCIPLES OF PLANT NUTRITION. A. D. Kursanov. Moscow, Akademiya Nauk S.S.S.R., 1955. 30p. (In Russian) (Book on display at Geneva Conference)

The application of labelled atoms in studying the distribution and transformations of nutrients in the soil and their uptake by plants. An account of certain results obtained with the aid of labelled atoms. (publisher's note)

7668

METABOLISM OF FLUORINE 18 IN DOMESTIC ANIMALS. Jesse D. Perkinson, Jr., Ira B. Whitney, Robert A. Monroe, W. E. Lotz, and C. L. Comar (Univ. of Tennessee—Atomic Energy Commission Agricultural Research Program, Oak Ridge). Am. J. Physiol. 182, 383-9(1955) Aug.

Amounts of F^{18} sufficient to permit studies up to 10 hours duration in domestic animals with non-toxic levels of total fluorine have become available from cyclotron production. The initial rate of disappearance of intravenously injected F^{18} from the blood was found to be 41 and 32% of the dose/min for the lamb and a mature cow, respectively. The over-all disappearance curve was resolved into 4 components, similar to comparable curves reported for Ca^{45}. Data from both sheep and cow experiments showed that absorption was rapid, probably occurring from the rumen. Generally, about 1% of the ingested dose represented the peak blood value which occurred at about 2 and 5 hours in the sheep and cow, respectively. The selective localization of F^{18} in the skeleton appeared to be similar to that of Ca as judged from bone and mandible autoradiograms. It was shown that some of the ingested F^{18} was deposited in various parts of the hen's egg and in cow's milk. (auth)

7669

TISSUE PREFERENCES FOR FATTY ACID AND GLUCOSE OXIDATION. Arthur Allen, Bernice Friedmann, and Sidney Weinhouse (Lankenau Hospital Research Inst. and Inst. for Cancer Research, and Temple Univ., Philadelphia). J. Biol. Chem. 212, 921-33(1955) Feb.

Various tissues of the rat in the form of slices or whole homogenates were allowed to oxidize added C^{14}-labeled fatty acids, both in the absence and in the presence of non-labeled glucose, and the degree of substrate oxidation was measured by the incorporation of C^{14} in respiratory CO_2. Under no circumstances did the presence of glucose lower the oxidation of the added fatty acids, even when its concentration was far higher than that of the fatty acid. The oxidation of endogenous palmitic acid of tissue lipides was likewise little affected by the presence of glucose. The data are taken to indicate that there is a basal fatty acid catabolism occurring generally in tissues, which is not suppressed by the abundant presence of carbohydrate. (auth)

7670

SURVIVAL OF RADIOCHROMATE-LABELED PLATELETS IN RABBITS. Mary C. Morgan, Richard P. Keating, and Edward H. Reisner, Jr. (St. Luke's Hospital, New York). J. Lab. Clin. Med. 46, 521-9(1955) Oct.

Rabbit platelets labeled in vitro with sodium chromate (Cr^{51}) survived on reinjection. Significant amounts of platelet radioactivity were recovered from the circulation for 3 days. Evidence is offered that the labeled platelets retain their function. Chromate tagging affords a tool of value in the study of the life span of platelets in the rabbit. (auth)

CHEMISTRY

7671 CCC-1024-TR-137

Virginia Polytechnic Inst., Blacksburg.

ALKALI HYDRIDE STUDIES. N. F. Murphy. Sept. 13, 1955. 10p.

A laboratory method of preparing sodium hydride in molten sodium hydroxide was developed. The sodium hydride in this solvent at 375°C was found to decompose as a pseudo-first order reaction, with a reaction velocity constant of 1.4 reciprocal hours. Teflon was found to be stable in molten sodium hydroxide, but unstable in sodium hydroxide solution of sodium hydride. Lithium hydride could not be prepared in triethylene glycol dimethyl ether at 186°C. (auth)

7672 NRL-Memo-209
Naval Research Lab., Washington, D. C.
PREPARATION AND PHYSICAL PROPERTIES OF BORAZOLE. S. H. Smith, Jr. and L. B. Eddy. Sept. 15, 1953. 13p. RDB Project NA 350-061.

A method for the synthesis of borazole, $B_3N_3H_6$, has been developed and the density, viscosity, surface tension, and refractive index of $B_3N_3H_6$ have been measured. The synthesis involves the following reactions $3BCl_3 + 3NH_4Cl \rightarrow B_3N_3H_3Cl_3 + 9HCl$, and $B_3N_3H_3Cl_3 + 3LiBH_4 \rightarrow B_3N_3H_6 + 1.5\ B_2H_6 + 3\ LiCl$. (C.W.H.)

7673 RMO-2013
International Minerals and Chemical Corp., Chicago.
URANIUM PRODUCTION — PROCESS DESIGNS FOR LEACHED ZONE PLANTS. VOLUME II. LEACHING SECTION. R. J. Piros, R. F. McCullough, and W. C. Knopf. Apr. 1953. Decl. Apr. 13, 1955. 49p. Contract AT(49-1)-545. (IMCC-2033)

Solubilization of values of +14 and −200 mesh fractions of leached zone, with sulfuric acid at atomspheric pressure, is considered. Basic design and economic information required for the process are presented. Design data for plants to produce 450, 225, and 100 tons or uranium per year have been developed. The 100 ton per year plant is considered to be the minimum practical unit capable of being expanded to either of the larger size plants. (auth)

7674 SO-2042
General Electric Co. Research Lab., Schenectady, N. Y.
ELECTROCHEMICAL TECHNIQUES IN THERMODYNAMICS. R. A. Oriani. Sept. 1955. 18p. Contract W-31-109-Eng-52. (55-RL-1387)

The use of galvanic cells employing nonaqueous electrolytes and operating at elevated temperatures is a relatively little known technique. Some of the details for the successful operation of such cells are described both for liquid and for solid alloys. The kind and the accuracy of the information obtained are discussed. Applications to the determination of phase diagrams are outlined, and the possibilities of obtaining surface free energies are discussed. (auth)

7675 UCRL-3051
California. Univ., Berkeley. Radiation Lab.
BONDING AND SPECTRA OF METAL CHELATES: ULTRAVIOLET, VISIBLE, INFRARED, AND ELECTRON RESONANCE ABSORPTION. NEAR-INFRARED SPECTRA OF ALCOHOLS (thesis). R. Linn Belford. June 1955. 192p. Contract W-7405-eng-48.

Optical spectra of six β diketones and their cupric chelates are presented and discussed in relation to the structures of the molecules. Infrared assignments are made made. The 300 mu bands of the metal chelates are shown to be shifted enolate ion absorptions. The order of magnitude and direction of the shifts are predicted correctly by a simple molecular orbital and electrostatic calculation. Visible spectra are correlated with the nature of the chelating agent. Preparations of most substances studied are described, as are some problems arising from attempted preparation of others. Absorption spectra, in the visible red and near infrared, are reported for solutions of bis-acetylacetono-Cu(II) and its 3-ethyl variant in various media. The spectra could arise from a set of three Gaussian components whose positions and intensities are shown to depend primarily upon solvent basicity. These component bands are identified with three $3d^1-3d^1$ transitions predicted from crystal field and molecular orbital theories. The behavior of these bands upon alteration of solvent and of chelate ring substituents appears consistent with the postulate that pi-bonding changes are energetically of less importance than changes in crystal field splitting and in sigma-bonding. An exploratory study of electron spin resonance in solutions of transition metal chelates in organic solvents has yielded promise of future application of the resonance technique to chemical problems. A visible absorption band unique to the solid state of nickel dimethylglyoxime is reported. Attempts to find other nickel chelates displaying the same feature failed. A search for electrical semiconductivity or photoconductivity in the nickel dimethylglyoxime crystals was unsuccessful. During a program of testing the instrument used to obtain the visible-region spectra, near-infrared spectra of a number of specially purified alcohols were observed. They showed the first three harmonics of the hydroxyl stretch frequency. The extreme sensitivity of these bands to hydrogen bonding permits one to distinguish between primary, secondary, and tertiary alcohols because of their different degrees of steric hindrance to such bonding. The near-infrared range seems promising as a "fingerprint" analysis region. (auth)

7676 UCRL-3116
California. Univ., Berkeley. Radiation Lab.
A STUDY OF THE $Ge-GeO_2$ AND $Si-SiO_2$ SYSTEMS. Petros Zavitsanos and Leo Brewer. Aug. 1955. 5p. Contract W-7405-eng-48.

The $Ge-GeO_2$ and $Si-SiO_2$ systems were studied by differential thermal analysis and the phase diagrams partially worked out. (auth)

7677 AEC-tr-2251
THE CONSTITUTION OF FUSED SALTS. (De Smeltete Salters Konstitusjon). Tormod Forland. Translated from Tidsskr. Kjemi Bergvesen Met. 11, 78-82(1951). 16p.

A survey is made of the experimental methods for studying fused salts and of the properties of fused salts, including the fusion process itself, characteristics of ions associated with the melting point, the heat of fusion, plasticity, thermodynamic measurements, electric conductivity, etc. (B.J.H.)

7678 AEC-tr-2281
THE YTTRIUM OXIDE−URANIUM OXIDE SYSTEM. F. Hund, U. Peetz, and G. Kottenhahn. Translated from Z. anorg. u. allgem. Chem. 278, 184-91(1955). 7p. Available from Associated Technical Services (Trans. 79G6G), East Orange, N. J.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-4486.

7679 AEC-tr-2282
THE FLUORITE PHASE IN THE $U_3O_8-Er_2O_3$ SYSTEM. F. Hund and U. Peetz. Translated from Z. anorg. u. allgem.

Chem. 267, 189-97(1952). 8p. Available from Associated Technical Services (Trans. 75G6G), East Orange, N. J.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 6-2354.

7680

SESSION OF THE ACADEMY OF SCIENCES OF THE U.S.S.R. ON THE PEACEFUL USE OF ATOMIC ENERGY. JULY 1-5, 1955. MEETINGS OF THE DIVISION OF CHEMICAL SCIENCES. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

Separate abstracts were prepared for the 18 papers compiled in this book. (L.M.T.)

7681

MOBILITY OF SULPHUR IN SULPHUR–CARBON BONDS AND MECHANISM OF ACTION OF RUBBER VULCANIZATION ACCELERATORS. G. P. Miklukhin. p.251-69 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

Results are presented of investigations of the mobility of bivalent sulphur in organic compounds having C—SH, C—SC, CS—SC, C—S and — C(=S)SR bonds, obtained by studying the exchange reactions of corresponding compounds with radioactive sulphur. Particular attention is devoted to isotope exchange of sulphur and hydrogen sulphide with sulphur-containing organic compounds used as accelerators of rubber vulcanization. (auth)

7682

SULPHUR EXCHANGE IN POLYSULPHIDES AND VULCANIZATION ACCELERATORS. E. N. Gur'yanova, V. N. Vasil'eva, and L. S. Kuzina. p.270-300 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

The radioactive sulfur isotope S^{35} was used in the work to find out the influence the structure of molecules exerts on the mobility of sulfur atoms in the bonds S—S, C—S, C=S of organic polysulfides and a number of other compounds, including vulcanization accelerators. (auth)

7683

KINETICS OF THE PASSAGE OF SULPHUR FROM PIG IRON INTO SLAG OF THE SYSTEM $CaO-Al_2O_3$. O. V. Travin and L. A. Shvartsman. p.48-68 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

The carbon and silicon contained in liquid pig iron tend to displace sulphur atoms, greatly increasing the thermodynamic activity of this element in the solution. This is one of the important reasons why pig iron can be purified of sulphur much more effectively than steel. It was thought advisable to use the radioactive isotope method for the determination of small concentrations of sulphur. For this purpose, radioactive sulphur S^{35} was introduced preliminarily into the pig together with ordinary sulphur. The experiments were carried out in a graphite cylindrical block heated by induction currents from a high-frequency generator and enveloped in an atmosphere of purified nitrogen. Four vertical holes 28-mm in diameter bored in the block served as the crucibles in which the pig iron and the slag added to it were melted. Each of these holes communicated in its lower part with a thin vertical canal 6-mm in diameter. The speed of desulphuration was determined by measuring the radioactivity of samples of pig iron taken through the thin canal by suction into a quartz tube. The experiments showed that the interaction between the pig iron and liquid slags of the system $CaO-Al_2O_3$ may result in a very high degree of purification of the metal from sulphur: its content went down to as low as the order of 10^{-4} per cent. (auth)

7684

SORPTION OF GASES ON EVAPORATED NICKEL FILMS. II. ADSORPTION AND DECOMPOSITION OF CARBON MONOXIDE AT LOW PRESSURES. PART I. Zenjiro Oda (Nippon Telegraph and Telephone Public Corp., Tokyo). Bull. Chem. Soc. Japan 28, 281-4(1955) June.

The adsorption of CO on a clean Ni surface at room temperature has been investigated. At temperatures ≤ 100°C, only adsorption was observed. (C.W.H.)

7685

SORPTION OF GASES ON EVAPORATED NICKEL FILMS. III. ADSORPTION AND DECOMPOSITION OF CARBON MONOXIDE AT LOW PRESSURES. PART 2. Zenjiro Oda (Nippon Telegraph and Telephone Public Corp., Tokyo). Bull. Chem. Soc. Japan 28, 285-90(1955) June.

The decomposition of CO on Ni surfaces by direct reaction to form CO_2 and Ni_3C at high temperatures (≥ 130°C) has been studied. The kinetics of decomposition is discussed on the basis of the non-uniformity of the Ni surfaces. (C.W.H.)

7686

THERMODYNAMIC PROPERTIES OF SOME GASEOUS HALOGEN COMPOUNDS. William H. Evans, Thomas R. Munson, and Donald D. Wagman. J. Research Natl. Bur. Standards 55, 147-64(1955) Sept.

Tables of values of the heat of formation, free energy of formation, logarithm of the equilibrium constant of formation, free-energy function, heat content function, entropy, heat content, and heat capacity, are given from 0°K to high temperatures for the following gaseous substances: F, F_2, F_2O, Cl, Cl_2, ClO_2, Cl_2O, ClF, ClF_3, Br, Br_2, BrF, BrF_5, BrCl, I, I_2, IF, IF_5, IF_7, ICl and IBr. The data used in preparing the tables are discussed in detail. (auth)

7687

STUDY OF CHEMICAL REACTION MECHANISMS WITH MOLECULAR BEAMS. THE REACTION OF K WITH HBr. Ellison H. Taylor and Sheldon Datz (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 23, 1711-18(1955) Sept.

The reaction between K and HBr has been studied by a molecular beam technique, using as a detector a surface ionization gauge with a tungsten and a platinum alloy filament, the former sensitive to KBr as well as to K and the latter essentially to K only. The activation energy is 3.4 ± 0.1 kcal/mole and the probability or steric factor is about 0.1. The angular distribution of the KBr suggests that collisions with the H end of the HBr are more often fruitful than other configurations. The total collision cross section for a beam of K at 504°K in HBr at 401°K is 850×10^{-16} cm^2. (auth)

7688
COMMENTS ON THE C^{13} ISOTOPE EFFECT IN THE THERMODECOMPOSITION OF ETHYL BROMIDE. Henry L. Friedman, Richard B. Bernstein, and Harry E. Gunning (Illinois Inst. of Tech., Chicago). J. Chem. Phys. 23, 1722-3(1955) Sept.

A radical chain mechanism for the thermodecomposition of ethyl bromide was examined and has displaced the unimolecular elimination mechanism. The results were inconclusive with regard to the C^{13} isotope effect. (C.W.H.)

7689
MECHANISM OF THE PYROLYSIS OF ETHYL BROMIDE. A NOTE ON A PAPER BY FRIEDMAN, BERNSTEIN, AND GUNNING. Allan Maccoll and P. J. Thomas (Univ. Coll., London). J. Chem. Phys. 23, 1722(1955) Sept. (cf. NSA 9-2143)

A radical chain mechanism is proposed for the thermal decomposition of ethyl bromide. This mechanism is supported by the experimental evidence that oxygen catalyzes the reaction. (C.W.H.)

7690
GEL FORMATION BY MAIN-CHAIN FRACTURE OF LONG-CHAIN POLYMERS. A. Charlesby (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Roy. Soc. (London) A231, 521-34(1955) Sept. 20.

The conditions are examined under which the fracture of main-chain bonds in a long-chain polymer, which would normally result in a decrease in average molecular weight, can nevertheless result in formation of a network of infinite extent (gel). It is assumed that the two end-groups produced at a fractured site can attack neighboring molecules, and link themselves to them. For an initially random distribution it is shown that gel formation will first occur when one molecule in three is thus fractured. The sol fraction is found to equal $(1/3r)^2$, where r/i is the average number of fractures per molecule; with increasing fracture density the sol therefore tends to zero. Where only a proportion of the fractures result in linking, the sol fraction decreases to a limiting value. Expressions are derived for many of the parameters of the sol and gel fractions and for the swelling. The results obtained are compared with those for crosslinking of polymers with a similar molecular weight distribution. To distinguish the process considered in this paper from that usually referred to as crosslinking, the term endlinking is proposed. (auth)

7691
RADIOACTIVE ELEMENTS. S. E. Bresler. Moscow-Leningrad, Gostekhizdat, 1952. 435p. (In Russian) (Book on display at Geneva Conference)

A monograph on the chemistry of radioactive substances and radiochemical methods of investigation. Radioactive series; analysis of the processes of concentration, separation and adsorption of radioactive substances. Fundamentals of the chemistry of radioelements and artificial radioactivity and of nuclear reactions. Methods of producing artificial radioactive elements and their compounds. Application of labelled atoms in chemical, biological, medical and geological research; bibliography after each chapter. (publisher's note)

AEROSOLS

7692 ANL-5429
Argonne National Lab., Lemont, Ill.
REMOVAL OF HALOGENS, CARBON DIOXIDE, AND AEROSOLS FROM AIR IN A SPRAY TOWER. R. C. Liimatainen and W. J. Mecham. Feb. 28, 1955. 37p. Contract W-31-109-eng-38.

The purification of air from laboratory exhausts by the absorption of possible impurities (halogen compounds, CO_2, and aerosols) in multiple-nozzle spray towers has been investigated. The absorptive properties of the spray towers were compared to those of packed towers. (C.W.H.)

ANALYTICAL PROCEDURES

7693 AMRL-209
Army Medical Research Lab., Fort Knox, Ky.
SPECIAL CUVETTES FOR SPECTROPHOTOMETRIC MEASUREMENTS OF MICRO-ORGANISMS AND LIVING TISSUES. Charles W. McKeehan and Irven C. Graham. Sept. 1, 1955. 7p. AMRL Project No. 6-64-12-028.

Two cuvettes for spectrophotometry of living tissues and microörganisms are described. They permit modifying the biological conditions during the measurements. (auth)

7694 RAE-MET-79
Gt. Brit. Royal Aircraft Establishment, Farnborough, Hants, England.
THE DETERMINATION OF MAGNESIUM OXIDE IN MAGNESIUM. H. J. Allsopp. Oct. 1954. 11p. (AD-50384)

The MgO content of Mg metal can be determined by sublimation of the metal in vacuum and titrating the Mg in a solution of the residue with disodium ethylenediaminetetraacetate. The time required for the determination is about 5 hr. (J.E.D.)

7695 WSL/M-181A(Prov.)
Gt. Brit. Windscale Works, Sellafield, Cumb., England.
THE FLUORIMETRIC DETERMINATION OF URANIUM: ANALYTICAL METHOD. C. J. Riley. Nov. 16, 1954. 4p. Report is based on method TD 34/4A. Method drafted by C. J. Riley.

A method for the fluorimetric determination of U in ore samples is described. The U samples are fused with a $NaF/NaHCO_3$ mixture, the cooled melt exposed to ultraviolet radiation, and the resultant fluorescence is measured electronically. (C.W.H.)

7696 Y-900
Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.
DETERMINATION OF PHOSPHORUS IN URANIUM METAL AND URANIUM OXIDES. Bonnie Anderson and W. B. Wright, Jr. Aug. 4, 1952. Decl. Oct. 18, 1954. 19p. Contract W-7405-eng-26.

Phosphorus in uranium metal and uranium oxides may be determined in the range of 10 to 600 ppm colorimetrically by measurement of the phospho-vanado-molybdate complex after the phosphorus and uranium have been separated by extraction of the uranium with tributyl phosphate. The method has a standard deviation of ±4.6% at about 100 ppm phosphorus. Average recovery of phosphorus from U_3O_8 spiked with 20 to 600 γ was 8.3% high (uncorrected for unknown phosphorus in the oxide).

7697
THE ANALYSIS OF FLUOROCARBONS: USE OF INFRARED SPECTROPHOTOMETRY FOR THE ANALYSIS OF SMALL SAMPLES. P. B. Ayscough (National Research Council, Ottawa, Canada). Can. J. Chem. 33, 1566-71(1955) Oct.

A method for the analysis of small quantities of mixtures of carbon tetrafluoride, hexafluoroethane, and fluoroform based on measurement of the intensity of infrared absorption bands is described. The relation between pressure and optical density for the main absorption bands of each gas was determined and used to calculate the composition of synthetic mixtures. These results were compared with those obtained by mass spectrometric analysis. (auth)

7698

AN INDIRECT COLORIMETRIC METHOD FOR THE DETERMINATION OF BERYLLIUM. M. Sunderasan and M. Sankar Das (Chemistry Division, AEE (Govt. of India) Bombay, India). Analyst 80, 697-99(1955) Sept.

A spectrophotometric method for the determination of beryllium is described; it is based on the precipitation of beryllium ammonium phosphate, which is subsequently determined spectrophotometrically as molybdophosphoric acid. By this method 2 ppm. of beryllium in the solution of a sample can be determined. Interference by most elements, including copper and nickel, is avoided by the use of ethylenediaminetetraacetic acid. The method is particularly useful for ores and alloys of low beryllium content. (auth)

7699

VOLUMETRIC DETERMINATION OF ZIRCONIUM. AN ETHYLENEDIAMINE TETRAACETATE METHOD INVOLVING BACK-TITRATION WITH BISMUTH. James S. Fritz and Marlene Johnson (Iowa State Coll., Ames). Anal. Chem. 27, 1653-5(1955) Oct.

Zirconium can be determined in acid solution by addition of excess ethylenediaminetetraacetate, followed by back titration with bismuth nitrate. Thiourea is used as the indicator. Very few metals form complexes which are strong enough to interfere with the method. Most complexing anions, including sulfate, phosphate, oxalate, thiocyanate, and tartrate, do not interfere. Fluoride (except in low concentrations) interferes but can be removed easily by fuming with perchloric or sulfuric acid. Slight modification of the procedure permits determination of zirconium in the presence of moderate amounts of thorium, titanium, niobium, or tantalum without separation. (auth)

7700

DETERMINATION OF OXYGEN IN SODIUM AND IN SODIUM-POTASSIUM ALLOY BY THE BUTYL BROMIDE METHOD. Louis Silverman and Mary Shideler (North American Aviation, Inc., Downey, Calif.). Anal. Chem. 27, 1660-2 (1955) Oct.

Modifications are suggested for the butyl bromide method for determining oxygen in sodium. Tools for breaking the glass capsule and for cutting the sodium are described. Chromatographic purification of the organic reagents by use of silica gel was found to be effective and far more rapid than earlier purification methods. Data are included to show the effectiveness of this type of purification, along with the appropriate drying agents. Liquid sodium–potassium alloy can be handled by initially freezing the alloy and then controlling the speed of reaction by the temperature. After the potassium has reacted, the sodium reaction is hurried by increasing the content of the butyl bromide. (auth)

7701

THE SPECTROCHEMICAL DETERMINATION OF MAGNESIUM AND BERYLLIUM IN ALUMINIUM ALLOYS USING A ROTATING DISC ELECTRODE. N. Haigh (Aluminium Labs., Ltd., Banbury, England). Metallurgia 52, 154-6(1955) Sept.

A spectrochemical method for the analysis of small amounts of magnesium and beryllium in aluminium alloys is described. The samples are dissolved in acid and examined by the rotating disc technique using a Hilger Medium Quartz spectrograph and uncontrolled spark source. The method is simple and less tedious than the existing chemical methods. (auth)

7702

THE DETERMINATION OF ZIRCONIUM IN ITS BINARY ALLOYS WITH NIOBIUM AND TANTALUM. G. W. C. Milner and J. W. Edwards (Atomic Energy Research Establishment, Harwell, Berks, England). Anal. Chim. Acta 13, 230-4(1955) Sept.

A procedure is presented for the determination of zirconium in the presence of niobium or tantalum. The bulk of the niobium or tantalum is first removed by extracting with hexone from a 10M hydrofluoric acid, 6M sulphuric acid solution of the sample. The zirconium is then separated from any unextracted earth acid element by precipitation with ammonium hydroxide followed by the addition of hydrogen peroxide. Under these conditions, both the niobium and tantalum form soluble peroxy complexes, whereas the zirconium is completely precipitated from solution. After the separation of the precipitate by filtration, it is re-dissolved in hydrochloric acid and the zirconium concentration is finally determined by titration with ethylenediaminetetraacetic acid. (auth)

7703

THE QUANTITATIVE SEPARATION AND DETERMINATION OF TANTALUM AND NIOBIUM USING ANION EXCHANGE CHROMATOGRAPHY. M. J. Cabell and I. Milner (Atomic Energy Research Establishment, Harwell, Berks, England). Anal. Chim. Acta 13, 258-67(1955) Sept.

A method is described for separating and determining niobium and tantalum in mixtures of the two. A solution of the two elements in 3M hydrofluoric acid is put on a column of Deacidite FF, the niobium is rapidly eluted with 3M hydrochloric-0.1M hydrofluoric acid and the tantalum is recovered by elution with 4M ammonium chloride–M ammonium fluoride. A complete separation is obtained and the two elements are recovered as their oxides after precipitation. The effects of some other elements have been examined. (auth)

7704

UTILIZATION OF ORGANIC COPRECIPITANTS IN ANALYTICAL CHEMISTRY. V. I. Kuznetsov. p.301-19 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

The author along with others elaborated methods of coprecipitation of Cu, Sr, Zn, Cd, In, Tl, Ti, Sn, Zr, Hf, P, Nb, Ta, Cr, Mo. W, Ni and other elements with organic coprecipitants, in some cases with simultaneous separation from almost all other elements. Even from 10^{-10}—10^{-11} mol. solutions coprecipitations are carried out quantitatively. All the experiments were carried out with the aid of radioactive isotopes. Organic coprecipitants are useful for preliminary concentration and separation of microquantities of element for the purpose of their subsequent determination

by spectral, polarographic or chemical methods. They are also useful for improvement of the existing and elaboration of new methods of isolation of radioactive isotopes without carriers, for estimation of the stability of complex compounds and for many other purposes. (auth)

7705

DETERMINATION OF THORIUM BY ORGANIC BASES. G. S. Deshmukh and J. Xavier (Hindu Univ. and Indian Assoc. for the Cultivation of Science, Calcutta). Bull. Chem. Soc. Japan 28, 233-4(1955) June

Thorium may be separated from the rare earths in aqueous solution by precipitation with the organic bases, o-anisidine and o-phenetidine. The Th precipitate is ignited to constant weight and Th is determined gravimetrically as ThO_2. (C.W.H.)

DEUTERIUM AND DEUTERIUM COMPOUNDS

7706 NBS-3985

National Bureau of Standards, Washington, D. C.
A REVIEW OF THE PROPERTIES OF DEUTERIUM COMPOUNDS. Annual Bibliography—1953. Lawrence M. Brown and Abraham S. Friedman. Sept. 1, 1955. 78p. Project 0302-10-2641.

FLUORINE AND FLUORINE COMPOUNDS

7707 HW-35807

Hanford Atomic Products Operation, Richland, Wash.
THE CALCIUM FLUORIDE–MAGNESIUM FLUORIDE–LITHIUM FLUORIDE SYSTEM. W. E. Roake. Mar. 15, 1955. 8p. Contract W-31-109-Eng-52.

Temperature composition relationships have been measured in the CaF_2–MgF_2–LiF system in the area of liquidus temperatures below 1000°C. A ternary eutectic composition was observed at 59.0 mol % LiF, 27.9 mol % MgF_2, and 13.1 mol % CaF_2 (all ± 0.2%). The melting point of the ternary eutectic was found to be 672°C. Solid solutions are formed except in the CaF_2 primary phase area. (auth)

7708 HW-35808

Hanford Atomic Products Operation, Richland, Wash.
THE CALCIUM FLUORIDE–LITHIUM FLUORIDE SYSTEM. W. E. Roake. Mar. 9, 1955. 5p. Contract W-31-109-Eng-52.

Temperature-composition relationships have been measured in the CaF_2–LiF system at compositions above 60 mol % LiF. A eutectic composition of 80.5 mol % LiF was observed melting at 769°C. No evidence of intermediate compounds or solid solutions was observed. (auth)

7709 NP-5773

Dow Corning Corp., Midland, Mich.
FLUORINE-CONTAINING POLYETHERS. Quarterly Report No. 2. O. R. Pierce, D. D. Smith, and R. M. Murch. Sept. 1, 1955. 19p. Contract AF33(616)-2417, Supplemental Agreement No. S2(55-1563).

The hypochlorination of 3,3,3-trifluoro-2-methyl-1-propene has yielded a product identified as 3,3,3-trifluoro-2-chloro-2-methyl-1-propanol. The peracid oxidation of fluorine-containing olefins has been under study. At present, the results are inconclusive. The synthesis of 1,1,3,3-tetrafluoro-1,2-epoxypropane is under investigation. (auth)

7710

KINETICS OF THE ISOTOPE EXCHANGE REACTION OF FLUORINE WITH HYDROGEN FLUORIDE. Richard M. Adams, Richard B. Bernstein, and Joseph J. Katz (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 23, 1622-4(1955) Sept.

The exchange of radioactive F^{18} between hydrogen fluoride and fluorine has been studied over a wide range of concentrations at three temperatures in the range 194° to 257°C. The exchange may be accounted for entirely by a heterogeneous catalysis mechanism involving competitive adsorption of the Langmuir-Hinshelwood type. Experiments have been performed indicating the important role of surface treatment on the kinetics of the exchange. (auth)

7711

EFFECT OF FLUORIDES AND OTHER ADDITION AGENTS ON THE CATHODIC POTENTIAL OF TITANIUM IN HYDROFLUORIC ACID. M. E. Straumanis, S. T. Shih, and A. W. Schlechten (Univ. of Missouri School of Mines and Metallurgy, Rolla). J. Electrochem. Soc. 102, 573-6(1955) Oct.

The absolute hydrogen overvoltage values of titanium in hydrofluoric acid increase, or the cathodic potentials, η_{II}, decrease (become more negative) with addition of alkali fluorides to the acid. The η_{II} decreases with increasing concentration of the salt in the sequence $NH_4F \rightarrow KF \rightarrow NaF$, which is also the sequence of decreasing cationic radius. For example, at 50 ma/cm^2 η_{II} decreases from −0.8 v in pure 0.1N hydrofluoric acid to −1.68 v in the same acid if it is 1M with respect to sodium fluoride. If the titanium cathode dissolves in the acid, the η_{II}-current density relationship is linear; if the dissolution ceases (at higher concentrations of the added fluoride), Tafel's relationship is fulfilled. In between there is a mixed straight line and quasi logarithmic relationship, the latter occurring at higher current densities. Organic colloid solutions of agar-agar or arabic gum appreciably decrease η_{II}; methylene blue solutions increase it slightly. (auth)

GRAPHITE

7712

TRANSMISSIVITY OF THIN CARBON FILMS. R. J. Thorn and G. H. Winslow (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 23, 1729-30(1955) Sept.

The optical properties of thin carbon films were examined at 2383° and 2424°K. Values were obtained for the index of refraction and the extinction coefficient. The reliability of the transmissivity method of measurement of deposition rates was demonstrated. (C.W.H.)

MOLECULAR STRUCTURE

7713

INVESTIGATIONS OF THE STRUCTURE AND REACTIVITY OF CHEMICAL COMPOUNDS BY ISOTOPE METHODS. A. I. Brodskii. p.210-37 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

The hydrogen exchange in X—H bonds is determined by the structure of the electronic cloud near the X atom. The tautomerism of H_3PO_2 was established. In ketones the H

mobility strongly depended on the σ-π hyperconjugation. The exchange of H in the aromatic nucleus was investigated. The kinetics of the O exchange in acids and salts has been studied. The halogen exchange in aliphatic halides was shown to be dependent on the structure of the radical. The mechanism of the formation, mutual transformation, and decomposition of the polythionates was examined. (auth)

7714

STRUCTURE AND REACTIONS OF COMPLEX COMPOUNDS. A. A. Grinberg. p.238-50 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

A short review of the works in this field is given. Major attention is paid to the exchange and substitution reactions. The following conclusions were made: The application of tracers makes it possible to verify and establish the stereochemical conceptions of coordination chemistry in a new manner. The same method permits a more profound insight into the mechanism of different reactions of complex compounds; the processes of exchange and substitution in the inner coordination sphere may proceed in different ways. The isotope exchange $[PtBr_4]^{2-}$ under the conditions studied proceeds via aquo-ion species. The possibility of extrapolation of such a mechanism over $[PtX_4]^{2-}$ compounds with other ligands requires experimental proof in each case; the lifetime of the metal-ligand bond may differ widely for various stable complexes; and the exchange rate of coordinated ligands is not necessarily determined by the thermodynamic stability of the complex in the sense of ionic dissociation. (auth)

RADIATION CHEMISTRY

7715 NYO-3273

Syracuse Univ., N. Y. Inst. of Industrial Research.
THE MECHANISMS OF SOME RADIATION INDUCED GAS REACTIONS AND THE CHEMICAL REACTIONS OF ELECTRONS. Annual Report for Period March 1, 1954 to January 1, 1955. Dept. of Chemistry. Benjamin P. Burtt. Jan. 1, 1955. 56p. Contract AT(30-1)-1131.

The effects of changes in pressure and intensity in the decomposition on ammonia have been investigated. The reactions between NO and O_2 in various ratios and in the presence and absence of frozen N_2O were studied. The decomposition of N_2O by x rays was shown to be independent of pressure in the range from 200 to 500 mm, while there is considerable difference at 55mm. The studies on the synthesis of HCl and the electron to negative molecular ion ratio in N_2O were continued. (For preceding period see NYO-3272.) (C.W.H.)

7716

THE EFFECT OF SOLUTES ON THE MOLECULAR YIELDS IN THE RADIOLYSIS OF AQUEOUS SOLUTIONS. Harold A. Schwarz (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 77, 4960-4(1955) Oct. 5.

The molecular H_2 yield produced by γ rays in KNO_2 and $CuSO_4$ solutions is found to decrease as the solute concentration is increased in the range of 10^{-5} to 1 molar. In $CuSO_4$ solutions, the Cu^{++} ion is the active species. Comparison of these data with published data on the effect of H_2O_2 on the H_2 yield and the effect of KBr and KCl on the molecular H_2O_2 yield shows that all of these yields vs. concentration curves coincide when the solute concentration is multiplied by a characteristic normalization constant. It is concluded that the mechanisms for formation of H_2 and H_2O_2 are similar as has been proposed by other authors. In the case of H_2 yields, the normalization factors are in the same ratio as the rate constants for reaction of H atoms with the solute wherever these are known. All of these results are consistent with the radical diffusion model in which H_2 and H_2O_2 are formed by combination of H and OH radicals as they diffuse out of a spur. A simple, approximate mathematical treatment of this model is given. (auth)

7717

STUDIES ON THE DECARBOXYLATION OF RADIOACTIVE GLUCURONOLACTONE BY IN VITRO SYSTEMS. Joseph L. Rabinowitz (V. A. Hospital, Philadelphia). J. Am. Chem. Soc. 77, 5180-2(1955) Oct. 5.

A soluble enzyme system from various tissues of the rat has been obtained which is capable of decarboxylating C^{14}-glucuronolactone as well as C^{14}-glucuronic acid. 6-C^{14}-glucuronolactone yielded CO_2 having six times the radioactivity of that obtained from uniformly labeled C^{14}-glucuronolactone. These results suggest that carbon six is the only carbon involved in this decarboxylation. (auth)

7718

ACTION OF IONIZING RADIATIONS ON AQUEOUS SOLUTIONS OF INORGANIC SALTS. N. A. Bakh. p.23-40 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

The influence of various factors (concentration, pH, dissolved gases) on the yields of products and the establishment of steady state conditions has been studied in irradiated solutions of ferrous and ferric salts, potassium iodide, and sodium nitrate. The relation between the establishment of a steady state in the liquid phase and the evolution of gas is discussed. Either total absence of gas evolution at steady state conditions or evolution of $2H_2 + O_2$ mixtures with constant yield is shown to prevail in different ferrous and ferric salt solutions. It is suggested that the ability of the solute to decompose H_2O_2 in a catalytic not radiation induced process (e. g., Fe^{3+}, J^--, Br^--ions) plays an important part in the evolution of $2H_2 + O_2$ gas upon radiolysis of aqueous solutions. NO_2^--ions and H_2O_2 are shown to be formed in irradiated $NaNO_3$ solutions with almost equal yields, varying with pH and concentration and attaining each 4 molecules per 100 ev in alkaline 1M solutions. Such yields cannot be accounted for if only H and OH radicals due to primary ionization are considered. Measurement of the redox potential during irradiation shows that besides NO_2^--ions and H_2O_2 other products of higher reducing power appear in the solution. It is stressed that in considering reaction mechanisms in irradiated systems all possible reactions, both radiation-induced and non-radiative, must be taken into account. (auth)

7719

SENSIBILIZATION AND SUPPRESSION OF REDOX REACTIONS UNDER RADIOLYSIS. M. A. Proskurnin, V. D. Orekhov, and E. V. Barelko. p.41-63 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic

Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

A survey is made of the reasons of the apparently insufficient reducing effect of atomic hydrogen when a reduction of nitrates in the solutions takes place. Experiments to determine initial efficiencies of this reaction are described which appeared to be approximately 2 molecules per 100 ev; the independence of this quantity of the pH is explained, and a description is given of the conditions under which the conjugated reaction proceeds with simultaneous oxidation of glucose and other substances, increasing the efficiency up to 13.5 equivalents. Cases of considerable increase of the efficiency of nitrate reduction, if the temperature is raised over 35°C, are cited, which also testifies to the participation, in the conditions, of excited water molecules. A consideration is made of these conditions of a reverse reaction of nitrite oxidation. The reaction of combining molecular nitrogen in the radiolysis of alkaline solutions is described. It is pointed out that a sharp increase of the velocity of back reaction takes place in case of heating irradiated solid potassium nitrate under a temperature exceeding the point of crystalline transition (129°C). Sensibilization of the reaction of oxidation of Fe^{2+} ions with participation of oxygen, when the acidity of the solutions is increased, is described. This makes it possible to achieve the maximum, up to 60 equivalents/100 ev, of Fe^{2+} oxidation efficiency independent of the nature of the acid (H_2SO_4, H_3PO_4, and HCl), oxygen pressure etc., which makes us think that this reaction has no chain character, but involves of up to 16 ionized and excited molecules of water. Investigations of radiation-chemical discoloration of methylene-blue water solutions are described. It is shown that in certain conditions there takes place either only the reduction of the dyestuff into a leuco-base with yield of 1.5 molecules per 200 ev, or only its irreversible oxidation with a yield of 1.6 molecules per 100 ev. Examples of sensibilization of the oxidation of benzene, benzyl alcohol and other compounds with the acids of ions of different valency are cited. The opinion is substantiated that the radical HO_2 is incapable of oxidizing aromatic compounds without oxidation carriers and that in this case a phenton-type reaction takes place which leads to utilization of oxidizing properties of HO_2. The oxidation of benzyl alcohol anhydrous conditions results in efficiencies testifying to a chain character of this reaction that, in addition to this, allows a strong post-irradiation effect. The efficiencies of all described reactions in which participation of excited molecules is supposed to approximate the utilization of 15 molecules of water or 20 molecules of alcohol; this does not contradict with the estimated values of excitation energies. (auth)

7720

SOME REGULARITIES OF THE MECHANISM AND KINETICS OF SIMPLE RADIATION-CHEMICAL REACTIONS. (FORMATION OF OZONE AND OXIDATION OF NITROGEN.) S. Ya. Pshezhetskii. p.64-78 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

The dependence existing between the processes of formation of ions and excitation of molecules, and the kinetics and other quantitative characteristics of radiation reactions was investigated, with the example of ozone formation and nitrogen oxidation under the action of γ-radiation and 200 to 300 kev or 10 to 400 ev electrons. Examination of the kinetics and the yield of these reactions showed that when liquid oxygen or liquid nitrogen-oxygen mixtures are irradiated, about 45 molecules of ozone per 100 ev of absorbed energy are formed. Under these conditions nitrogen oxides are formed with a yield of about 1.5 molecules per 100 ev of absorbed energy. (auth)

7721

RADIATION CHEMISTRY AND HOT ATOM CHEMISTRY. John E. Willard (Univ. of Wisconsin, Madison). Ann. Rev. Phys. Chem. 6, 141-70(1955).

Significant researches in the fields of radiation chemistry and hot atom chemistry are summarized. Among the topics reviewed were energy and charge transfer mechanisms, chemical effects of radiation on solids and "hot" reactions. (C.W.H.)

RADIATION EFFECTS

7722 KAPL-731

General Electric Co. General Engineering Lab., Schenectady, N. Y.

SUMMARY OF AVAILABLE DATA ON RADIATION DAMAGE TO VARIOUS NON-METALLIC MATERIALS. E. L. Mincher. Apr. 2, 1952. Decl. Feb. 15, 1955. Contract W-31-109-Eng-52. (R51GL19)

Data on the effects of pile radiation on organic and inorganic materials are summarized. The effects of γ radiation on the viscosity of lubricants, β and γ radiation on the tensile strength and electrical resistivity of plastics and synthetic rubbers, and neutron radiation on the electrical properties of ceramic insulators are tabulated. (C.W.H.)

7723

CATALYTIC ACTIVITY INDUCED BY NEUTRON IRRADIATION OF INERT SILICA. P. B. Weisz and E. W. Swegler (Socony-Vacuum Labs., Paulsboro, N. J.). J. Chem. Phys. 23, 1567-8(1955) Sept.

In pure silica gel, irradiation with 2 to 8×10^{18} fast neutrons/cm^2 produced a significant increase in catalytic activity for the double-bond isomerization in hexene. The effect is believed to be due to lattice dislocations. (auth)

7724

OXIDATION STATES OF PHOSPHORUS-32 PRODUCED BY NEUTRON IRRADIATION OF POTASSIUM CHLORIDE. T. A. Carlson and W. S. Koski (Johns Hopkins Univ., Baltimore, Md.). J. Chem. Phys. 23, 1596-8(1955) Sept.

An investigation of the oxidation states of P^{32} formed by neutron irradiation of KCl shows that like the simultaneously formed S^{35} the ratio of the different oxidation states depends on the preirradiation treatment. Through outgassing of the crystals results in the production of lower oxidation states. On the other hand, the oxidation states of P^{32}, unlike S^{35}, are strongly affected by the presence of x- or γ radiation. The recoil energy of the newly formed P^{32} fragment seems to have little effect on its final oxidation state. (auth)

7725

THE ACTION OF NUCLEAR RADIATIONS ON HIGH POLYMERIC COMPOUNDS. V. L. Karpov. p.3-22 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use

of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

A study of the changes in mechanical properties, solubility, and molecular weight taking place under irradiation showed that, depending on molecular structure of the polymer, one of the following two types of processes prevails, "cross-linking" or destruction. "Cross-linking" dominates in polyethylene, polyvinylchloride, natural rubber, and polyvinylbutyral; destruction—in polyisobutylene, polymethylmetacrylate, polyvinylacetate, polyvinyl alcohol, thermovulcanizate of polybutadiene, and polytetrafluorinethylene. The gases evolving during the irradiation of various polymers were investigated. They consisted primarily of hydrogen and considerably lesser quantities of molecular fragments from C_1 to C_4, formed when the bonds at the ends of the chains or in the lateral groups are broken. It was found that under irradiation of the crystalline polymers by electrons, γ-rays of Co^{60} and α-particles of radon an irreversible transition into the amorphous state takes place in the case of polyethylene, some polyamides and copolymers of vinylchloride and vinylidenchloride. The possible mechanism of crystal destruction was examined. It was shown with the aid of the spectral method that under irradiation in polyethylene a predominant formation of double bonds of the trans RCH = CHR' type is observed, the degree of branching is increased and various types of "cross-linking" are observed. It was also found that under irradiation in the air oxidation of polyethylene takes place with the formation of carbonyl, carboxyl, hydroxyl, and other groups. The possible mechanism of molecular transformations of polyethylene was considered in the case of irradiation with participation of radicals and excitated molecules. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

7726 ISC-626

Ames Lab., Ames, Iowa.

THE KINETICS OF THE Ce(IV)–Ce(III) EXCHANGE REACTION IN PERCHLORIC ACID. Frederick R. Duke and Frank R. Parchen. July 21, 1955. 18p. Contract W-7405-eng-82.

The rate of the $Ce^{4+}-Ce^{3+}$ exchange reaction is found to be first order in Ce^{3+}, first and second order in Ce^{4+} and complex order in $[H^+]$. At high acidities, the Ce^{4+} and $[H^+]$ dependencies are best explained by the reaction of Ce^{3+} with the species $Ce(OH)_2^{2+}$, $Ce(OH)_3^+$, and $[CeOCeOH]^{5+}$. At low $[H^+]$ more highly hydrolyzed and polymerized species appear to be involved. (auth)

SEPARATION PROCEDURES

7727 AECU-2988

Michigan. Univ., Ann Arbor.

RADIOCHEMICAL SEPARATION BY ISOTOPIC EXCHANGE: A RAPID, HIGH DECONTAMINATION METHOD FOR SILVER. Duane N. Saunderman and W. Wayne Meinke. Jan. 21, 1955. 5p. Contract AT(11-1-)-70.

A rapid, high decontamination, single step method, based on the fast exchange of Ag^+ between a AgCl precipitate and $AgNO_3$ solution, has been developed for the separation of radioactive Ag from a solution containing other radioactive species. (C.W.H.)

7728 WIN-16

National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.

PRECIPITATION OF URANIUM AND VANADIUM FROM CARBONATE LEACH LIQUORS USING SODIUM AMALGAM. H. E. Dixon. Sept. 20, 1955. 32p. Contract AT(49-6)-924.

A preliminary evaluation of the amalgam process, determination of the optimum operating conditions in the laboratory, and development of basic equipment designs which could be adapted to pilot plant operation were investigated. Laboratory work was conducted on both natural and artificial carbonate leach solutions using various types of contactor equipment. The precipitation process depends upon producing sodium amalgam in an electrolytic mercury cell and contacting the amalgam with a leach solution in a suitable reactor. The pH of the liquor is increased (due to the side reaction of sodium with water) to a level sufficient to precipitate uranium as sodium diuranate. At the same time, the liquor is being reduced by the sodium amalgam with a subsequent precipitation of vanadium apparently as an isoluble V^{+++} compound. (auth)

7729 AEC-tr-2269

PHYSICO-CHEMICAL STUDIES OF HIGH-MOLECULAR ELECTROLYTES. III. STUDY OF ION EXCHANGER. PART 1. INFRARED SPECTROPHOTOMETRIC DETERMINATION OF ION EXCHANGE EQUILIBRIUM CONSTANTS. Hiroshi Sobue and Yoneho Tabata. Translated from J. Chem. Soc. Japan, Ind. Chem. Sect. 57, 469-71(1954) 6p. Available from Associated Technical Services (Trans. 15G7J), East Orange, N. J.

The method of application of the infrared absorption spectrum to the study of the mechanism of ion exchange reactions was described. A formula for the determination of the exchange equilibrium constant was derived. The equilibrium constant was determined in the case of a few examples of ion exchangers of the weak acid type. The following characteristic features of exchange were found: the exchange reaction is almost completed in the first 20 to 30 min. After that the reaction proceeded slowly. The establishment of equilibrium was practically complete in 2 to 3 hr, although 10 hr were required for the attainment of the true equilibrium; the exchange of Na^+ as well as of Ca^{2+} proceeded rapidly at pH of about 4. In the case of NH_4^+ the amount of exchange increased gradually over a fairly wide range of pH values. Appreciable difference exists between the two groups of cases; the equilibrium constant decreased with increasing pH of the solution. (auth)

7730 AERE-Lib/Trans-530

PRESENT DAY PROBLEMS OF ION EXCHANGE. F. Helfferich. Translated by R. S. Forsyth from Angew. Chem. 67, 13-16(1955). 7p.

Theoretical and experimental studies on ion exchange are reviewed, and problems associated with these studies are discussed. Topics discussed include equilibrium and selectivity; activity coefficients; ion pair formation from the viewpoint of kinetic, electrochemical, and equilibrium measurements; the electrochemistry of exchanger membranes; catalysis; and new ion exchangers. (C.H.)

7731

RADIUM–BARIUM SEPARATION PROCESS. Murrell L. Salutsky and Joseph G. Stites, Jr. (Mound Lab., Miamisburg, Ohio). Ind. Eng. Chem. 47, 2162-6(1955) Oct.

Fractionation of mixtures of radium and barium by precipitation of the chromates from homogeneous solution is proposed as a faster and easier method for concentrating radium. In 6 fractionation steps the barium:radium ratio was decreased from 102,300:1 in the original mixture to 62:1 in the product, and increased to 121,700,000:1 in the radium-impoverished fraction. A yield of approximately 95% was obtained. The chromate method is more practical than the crystallization method on the basis of enrichment per fractionation step, control of precipitation conditions, simplicity, and speed of operation. (auth)

SPECTROSCOPY

7732 AEC-tr-2252
INFRARED ABSORPTION SPECTRA OF GASEOUS ORGANIC COMPOUNDS ADSORBED ON MICROPOROUS GLASS. A. N. Sidorov. Translated from Doklady Akad. Nauk S.S.S.R. 95, 1235-8(1954). 6p.

Microporous glass having a mean pore-diameter of 30 to 40 A was used in the study of the far infrared spectra of 10 gaseous organic compounds adsorbed on the glass. Results are tabulated and analyzed. (B.J.H.)

SYNTHESES

7733 UCRL-2677
California. Univ., Berkeley. Radiation Lab.
PREPARATION OF SODIUM HEPTANOATE-7-C^{14}. Robert M. Noller. Aug. 31, 1955. 7p. Contract W-7405-eng-48.

A method for the preparation of long-chain carboxylic acids has been adapted to the preparation of heptanoic-7-C^{14} acid. (auth)

TRACER APPLICATIONS

7734
BIOSYNTHESIS OF C^{14}-LABELED COTTON CELLULOSE FROM D-GLUCOSE-1-C^{14} AND D-GLUCOSE-6-C^{14}. F. Shafizadeh and M. L. Wolfrom (Ohio State Univ., Columbus). J. Am. Chem. Soc. 77, 5182-3(1955) Oct. 5.

Cotton cellulose-C^{14} has been synthesized by the introduction of D-glucose-1-C^{14} and D-glucose-6-C^{14} into maturing cotton bolls. Radiochemical yields of 10.6% and 23.5%, respectively, were obtained. (C.W.H.)

TRANSURANIC ELEMENTS AND COMPOUNDS

7735
ISOTOPIC EXCHANGE REACTIONS OF NEPTUNIUM IONS IN SOLUTION. III. THE EFFECT OF CHLORIDE AND NITRATE IONS ON THE RATE OF THE Np(V)–Np(VI) EXCHANGE. Donald Cohen, J. C. Sullivan, and J. C. Hindman (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 77, 4964-8(1955) Oct. 5.

Possible catalytic effects of nitrate and chloride ions on the rate of the isotopic exchange reactions between Np(V) and Np(VI) have been investigated. Nitrate ion has little influence on the exchange rate. A marked catalysis is found in chloride solution. The results have been analyzed in terms of the formation of the complexes NpO_2Cl^+ and NpO_2Cl_2. Data are given on the energetics of the various exchange paths and for the formation of the complex species. Mechanisms for the exchange reaction are discussed. (auth)

URANIUM AND URANIUM COMPOUNDS

7736 NP-5775
Canada. Dept. of Mines and Technical Surveys. Mines Branch.
THE APPLICATION OF THE ELECTRIC IGNITION BOMB TO THE SUGAR CARBON–SODIUM PEROXIDE METHOD FOR DISSOLVING REFRACTORY ORES. J. C. Ingles. Aug. 22, 1955. 13p. (TR-131/55)

A method has been developed for the dissolution of refractory uranium ores by the sugar carbon–sodium fusion technique utilizing an electric ignition bomb for carrying out the fusion. (C.W.H.)

7737
MAGNETIC SUSCEPTIBILITIES OF SOME URANIUM(IV) COMPOUNDS. Clyde A. Hutchison, Jr. and Charles M. Herzfeld (Univ. of Chicago). J. Chem. Phys. 23, 1650-5 (1955) Sept.

The magnetic susceptibilities of $U(SO_4)_2 \cdot 4.22H_2O$, $U(C_2O_4)_2 \cdot 6H_2O$, $UF_4 \cdot NaF$, (γ)$UF_4 \cdot 2NaF$, and $UF_4 \cdot 3NaF$ have been measured in the temperature range from 14°K to 300°K. The results are presented in graphical form and their general form is discussed. The susceptibilities of all five compounds appear to approach finite values at 0°K. (auth)

ENGINEERING

7738 AECU-3003
Baldwin-Lima-Hamilton Corp., Philadelphia.
HIGH TEMPERATURE STRAIN GAGE RESEARCH. Summary Report. Francis G. Tatnall. Jan. 25, 1955. 120p. Contract Nonr-845(00) and Subcontract No. 513 under W-7405-eng-26 for Oak Ridge National Lab.

7739 NACA-TN-3212
California Inst. of Tech., Pasadena.
A NONLINEAR THEORY OF BENDING AND BUCKLING OF THIN ELASTIC SHALLOW SPHERICAL SHELLS. A. Kaplan and Y. C. Fung. Aug. 1954. 58p.

The problem of the finite displacement and buckling of a shallow spherical dome is investigated both theoretically and experimentally. In the theoretical approach the nonlinear equations are converted into a sequence of linear equations by expanding all of the variables in powers of the center deflection and then equating the coefficients of equal powers. Experimental results seem to indicate that the classical criterion of buckling is applicable to very shallow spherical domes for which the theoretical calculation was made. A transition to energy criterion for higher domes is also indicated. (auth)

7740 AEC-tr-2272
THERMAL STRESSES IN PLATES AND SHELLS. S. G. Vinokurov. Translated from Izvest. Kazan. Filiala Akad. Nauk. S.S.S.R., Ser. Fiziko-Matemat. i Tekh. Nauk, No. 3, 18-38(1953). 23p. Available from Associated Technical Services (Trans. 96G6R), East Orange, N. J.

By introducing an auxiliary stress, transformation was made of the equations of elastic theory of a three-dimensional body—the equations of the theory of shells in generalized coordinates and in lines of curvature. Examples are given

of the application of Galerkin's method and the method of energy to the solution of non-linear problems in elastic theory which involve a non-uniform temperature distribution. (auth)

7741 AERE-Lib/Trans-560

ANALYSIS OF THE OPERATION AND CHOICE OF THE TYPE AND DIMENSIONS OF VERTICAL CENTRIFUGAL STEAM SEPARATORS. E. F. Buznikov. Translated by J. B. Sykes from Ekon. Topliva Za 1, 8-14(1951) 11p.

The design of an efferent vertical centrifugal steam separator is discussed. The nature of the mechanism of centrifugal separation of water in a vertical separator is discussed, and a comparison is made of the experimental and calculated characteristics of separators. Separators of this type are reported to give satisfactory service in boilers of Sovient electric stations and boiler houses. (C.H.)

7742

INVESTIGATION OF THE WEAR PROPERTIES OF OILS AND FUELS WITH THE AID OF RADIOACTIVE ISOTOPES. Yu. S. Zaslavskii. p.115-39 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

A high-speed investigation of the anti-wear properties of lubricating oils is achieved by tests made in one-cylinder engines with the upper pressure piston ring subjected to bombardment with neutrons on F^{19} or containing admixtures of Zn^{65}. The radioactivity of the oil is measured when the engine is running either by taking samples in a test tube inserted in a block of six gamma Geiger counters placed in a lead chamber, or by connecting a block of counters in the oil line of the engine. Measurement of the radioactivity of the standard solution of a batch of the irradiated metal is carried out in a vessel, the form of which is the same as that in the lubricating line in which the radioactivity of the oil in the engine is being measured. Because of similar measurement geometry it becomes possible to reduce the radiometric wear data of the radioactive part to weight indices. This method makes it possible to eliminate preliminary calibration of the lubricating line proposed by scientists abroad. An investigation was made of the influence of revolutions and loads of the wear of a one-cylinder four-stroke carburetor engine running on different-quality oils at high and low temperatures of the cooling water. It was established that the engine wear increases with an increase in the revolutions and loads, and the difference in the anti-wear properties of the oils becomes clearer. In studying the corrosion of ferrous and non-ferrous metals and alloys under the action of lubricating oils, use was made of radioactive metal plates periodically immersed in test tubes containing the oils being tested; the temperature of the oils was thermostated at a given level. The corrosion dynamics of steel and cast iron was established in motor oils with and without additives. Temperature curve maximums have been found for cast-iron and steel corrosion under the action of motor oils. The introduction of radiosulphur S^{35} and radiophosphorus P^{32} into anti-corrosion additives to motor oils has made it possible to study the kinetics of the formation of protection films on the surface of various metals and alloys. An investigation has been made of the character of the temperature curves of film-formation by sulphur- and phosphorus-containing additives on various metals. (auth)

7743

INVESTIGATION OF STEAM CONTAMINATION AND THE STRUCTURE OF THE STEAM–WATER MIXTURE BY MEANS OF RADIOACTIVE ISOTOPES. M. A. Styrikovich. p.210-27 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

One of the most important factors ensuring reliable and economical operation of modern steam turbine plants is high quality of the steam (the salt content should not exceed 0.1–0.2 mg/kg and the silica content 0.03–0.05 mg/kg). However, an investigation of the processes determining the steam purity is difficult because of insufficient sensitivity and selectivity of the analytic methods, which resulted in extreme discrepancies in the experimental data and their interpretation. A method of investigating the processes of steam contamination with the aid of radioactive isotopes was worked out which made it possible to determine the separate salts in the steam, at concentrations of up to 10^{-4} mg/kg. At present, this method is widely used in the USSR in laboratories and in pilot plants. Using this method, a number of institutes investigated the dependence of the steam contamination upon the load of the steam space and its height and upon the salt content in the boiler water in a very broad range of contamination coefficients (0.001%–0.5%) and pressures (1–190 atm). It was established that the contamination coefficient "W" at low loads is approximately proportional to the load ($W = cD^{0.5}$), whereas at large loads the dependence increases ($W = cD^{2}$ and further $W = cD^{4.5}$). In practice, steam boilers operate in the load interval corresponding to the 1st and 2nd regions. In the case of a large salt content in the boiler water, there is a great increase in the actual water level at the expense of a reduction in the relative velocity of the steam, but drop contamination is increased many times also with the actual height of steam space remaining constant. A detailed investigation has been made of steam contamination due to solubility; it has been established that the coefficient of the distribution of all investigated substances between the steam and the water does not depend on the concentration of the aqueous solution in a broad variation range of the latter (from 1 mg/kg to 10,000 mg/kg). In the case of all the substances investigated (SiO_2, NaOH, NaCl, LiCl, $CaCl_2$, Na_2SO_4, $CaSO_4$) the coefficient of the distribution of a substance between the two phases is a simple exponential function of the density ratio of these phases, $K = \sqrt{(\gamma'/\gamma'')^n}$ where n is a constant for a given substance right up to the critical pressure. The least value of n and the greatest values of K are found in the case of SiO_2; then follow hydroxides and chlorides; sulphates give very small values of K. (auth)

AEROSOLS

7744 AECU-3072

Los Alamos Scientific Lab., N. Mex.

AEROSOL COLLECTION BY WETTED FIBERGLAS MEDIA. Joseph A. Leary, Robert A. Clark, R. Philip Hammond, and Charles S. Leopold. Apr. 28, 1954. 48p. Contract [W-7405-eng-36].

A wet collection system for aerosols has been developed using fibrous media. Tests show the performance to be in accord with recently developed theory of collection by fibrous media. The effects of varying aerosol particle size,

particle density, and gas velocity have indicated that inertial impaction is the primary collection mechanism. Three-year operating experience on several full scale plant installations shows reliable performance. (auth)

HEAT TRANSFER AND FLUID FLOW

7745 AERE-Lib/Trans-561

NEW RESULTS ON THE TEMPERATURE DISTRIBUTION IN A BOILER WATER PIPE AT VERY HIGH PRESSURES. M. A. Styrikovich and M. E. Shitsman. Translated by J. B. Sykes from Doklady Akad. Nauk S.S.S.R. 96, 69-72(1954). 5p.

As a result of the investigation made on the limits of safe operating temperature conditions in a vertical boiler water pipe of diameter 30 mm at very high pressures (182 to 209 kg/cm^2) it has been found that: The region of unstable surface temperature, in the range of specific thermal fluxes and circulation parameters investigated, is found for weight steam contents considerably less than unity. For applied weight steam contents of over 300 kg/m^2sec, there is a considerable range of intermediate temperature distributions, characteristic of an increased steam content and a gradual decrease of the heat exchange from the values found in bubble boiling to those corresponding to dry saturated steam. The treatment of the "destruction of normal circulation" merely as a phenomenon of standstill or reversal of the circulation is not in accoradnce with the properties of processes in boilers at very high pressures. For specific thermal fluxes of (400 to 450) $\times 10^3 kcal/m^2h$, a decrease in the circulation rate to 0.4 or 0.5 m/sec, the weight steam velocity being about 100 or 150 kg/m^2sec, i.e. a decrease of the multiplicity of the circulation to 2 or 2.5, brings about a serious destruction of the normal circulation, which may lead to undesirable consequences. (auth)

MATERIALS TESTING

7746 WADC-TR-52-252

Minnesota. Univ., Minneapolis and Syracuse Univ., N. Y. DYNAMIC TESTING OF MATERIALS AND STRUCTURES WITH A NEW RESONANCE-VIBRATION EXCITER AND CONTROLLER. B. Lazan, A. Gannett, P. Kirmser, J. Klumpp, and J. Brown. Dec. 1952. 46p. Contract AF33 AF33(038)-18903. (AD-6354)

The nature of near-resonance vibration and response characteristics are discussed to clarify the relationships among resonance amplification factor, damping energy and dynamic modulus of elasticity. A newly developed machine is described for exciting and controlling resonance or near resonance vibrations in materials and joints under various types of stress. This machine imposes an adjustable-while-running mechanical exciting force at a controllable frequency and by means of automatic electronic controls maintains (a) the desired vibration phase angle (usually 90° for resonance) by controlling the frequency of the exciting force, and (b) the desired magnitude of the excited force by automatically controlling the magnitude of the exciting force. Equations are developed for determining the resonance amplification and other properties from the machine readings. The stability and accuracy of the machine are discussed. Data are presented on the damping and elasticity properties of aluminum and mild steel, and these are compared with results procured in rotating cantilever beam equipment. The resonance response, damping, and elasticity properties of a bolted joint were determined and the effects of bolt tension and molybdenum disulfide lubrication are illustrated and partially analyzed. (auth)

7747

OPERATING CHARACTERISTICS OF MEMBRANES. Donald H. Hagerbaumer and Karl Kammermeyer (State Univ. of Iowa, Iowa City). A. I. Ch. E. Journal 1, 152-6(1955) June.

Equilibrium permeability data for porous-glass membranes to O_2, N_2, and CO_2 under various operating conditions are presented. Deviations from expected values are discussed. (C.W.H.)

PUMPS

7748 KAPL-709

Knolls Atomic Power Lab., Schenectady, N. Y. ELECTROMAGNETIC PUMP SECTOR THERMAL TESTS. D. B. Vail. Feb. 27, 1952. Decl. Apr. 22, 1955. 180p. Contract W-31-109-Eng-52.

Initial design considerations for an electromagnetic pump to be used in a high temperature liquid metal system indicated that a limiting feature of the application was the winding insulation temperature. Several unusual methods were studied to prevent hot spot winding temperatures. To increase the thermal conductivity between the winding insulation and the coolant, two methods were studied, and tested, as follows: low silicon steel laminations were copper-brazed to the backplate of the pump, a high silicon steel lamination stack with every fourth lamination of copper was soldered to the backplate of the pump. To reduce the thermal conductivity between the high temperature duct and the laminations, two methods of introducing heat barriers were examined, as follows: ceramic support pads in combination with air spaces, a multiple layer, stainless steel strip and screen combination. The results of tests indicated that the stainless steel strip-screen heat barrier was a more satisfactory insulator than the ceramic pad arrangement. They also showed that the model with the soldered backplate had thermal characteristics comparable to the model with the brazed backplate, although theoretically the former should be superior. Temperature distributions and heat flows were calculated with reasonable accuracy. (auth)

RADIOGRAPHY

7749

USE OF RADIOACTIVE COBALT IN GAMMA-DEFECTOSCOPY. A. V. Bibergal, V. V. Bochkarev, B. M. Isaev, U. Ya. Margulis, and G. M. Frank. Akademiya Nauk S.S.S.R., 1951. (In Russian) (Book on display at Geneva Conference)

Results of investigations carried out for the purpose of obtaining data for the practical application of artificial and radioactive cobalt in γ defectoscopy. Main problems connected with the use of Co^{60} in defectoscopy. Description of new devices developed for applying Co^{60} with an activity of up to 100 g-equiv. of radium in γ defectoscopy. New technical opportunities in this field. (publisher's note)

TRACER APPLICATIONS

7750

METHODS OF STUDY AND CONTROL OF MACHINE WEAR BY MEANS OF RADIOACTIVE ISOTOPES. P. E. Dyachenko. Akademiya Nauk S.S.S.R., 1954. (In Russian) (Book on display at Geneva Conference)

Experience of Soviet research institutes and industrial plants in the use of radioactive isotopes for the investigation of the wear of machine parts. The superiority of the radioactive isotope method over other methods in wear estimation (weighing, micrometric measuring, prints etc.). Analysis of the applicability of radioactive isotopes for wear estimation; description of the apparatus required for such investigations, the principles of selecting the radioactive substances, and calculation of the activity of the isotopes used. Methods of activating friction surfaces (electrolytic coating with radioactive layer, introduction of radioactive isotopes into the parts during casting, introduction of wear witnesses by the insert method irradiation, diffusion and electric spark treatment methods). Method of simultaneous measurement of the wear of several parts with radiations of different types or of the same type but different energies. Safety rules; instructions for equipping laboratories for work with radioactive isotopes; application of radioactive isotopes in cutting down machine wear. (publisher's note)

WASTE DISPOSAL

7751

WASTE DISPOSAL IS VITAL TO ATOMIC POWER DEVELOPMENT. John M. Warde (Oak Ridge National Lab., Tenn.) and Raymond M. Richardson (Geological Survey, Memphis). J. Metals 7, 1090-2(1955) Oct.

The problems of the disposal of liquid, gaseous, and solid radioactive wastes are discussed. (J.E.D.)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

7752 NYO-4631

Massachusetts Inst. of Tech., Cambridge.

STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES. Quarterly Progress Report for the Period Ending July 1, 1955. F. H. Norton and W. D. Kingery. July 1, 1955. 14p. Contract AT(30-1)-1192.

Measurements of surface and interface energy in the system Ni–Al_2O_3 have been completed for small additions of Sn, In, Cr, and Ti in the liquid phase. Tin and indium are moderately surface active, while chromium and titanium have no effect on liquid surface tension. In contrast, tin and indium have little effect on interface energy, while chromium and titanium are markedly interface active. Adsorption at the interface is closely connected with the free energy of metal–oxygen bond formation. The surface energy-density ratio for GeO_2 has been determined. (auth)

7753

INFLUENCE OF THE REFRACTORY MATERIALS OF STEEL-POURING DEVICES ON THE CONTAMINATION OF STEEL WITH NON-METALLIC INCLUSIONS. E. S. Kalinnikov and A. M. Samarin. p.3-28 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

In search of a refractory which would be stable against the action of steel and slag, and suitable as a lining material for steel-pouring devices, the influence of ladle and launder linings made of chamotte, kaolin and high alumina brick was studied. In preparing these linings the radioactive isotope Ca^{45} was introduced into the composition of all three types of firebrick, taking care to distribute it evenly throughout both the chamotte grains and the binder. The ball-bearing steel used was smelted in 20-ton basically lined furnaces and was bottom poured. The influence of the refractories of the ladle and launder linings on the contamination of the steel with non-metallic inclusions was determined from the results of measuring the activity of the non-metallic inclusions after isolating them by electrolytic dissolution. Besides this, the usual methods of investigation were also used. It was found that the amount of exogenic inclusions in relation to the total non-metallic inclusion content depends on the composition of the refractory material the ladle lining is made of. A chamotte lining accounts for an average of 4.6% of the total content of non-metallic inclusions in the steel, a kaolin lining—for 2.7%, and a high alumina—for 1.5%. There exists a direct connection between the content of exogenic inclusions due to the destruction of the ladle lining, the average oxide inclusions number, and the amount of specimens with an oxide number over 2.5. The stability of chamotte brick to slagging is five times as low as that of high-alumina brick and twice as low as that of kaolin brick. High-alumina brick may be considered the best of the refractories studied for lining ladles. The launder lining has little influence on the contamination of the steel. (auth)

CORROSION

7754 AECU-3075

Case Inst. of Tech., Cleveland.

AN INVESTIGATION OF SCALING OF ZIRCONIUM AT ELEVATED TEMPERATURES. Quarterly Status Report No. 9 [for] June 2, 1955 to September 2, 1955. H. M. Green, H. E. Tuchschmid, and W. M. Baldwin, Jr. Sept. 6, 1955. 9p. Contract AT(11-1)-258.

To obtain a better understanding of the mechanism involved in the scaling behavior of zirconium, kinetic studies were made of the weight pickup in air after pretreating by exposure to oxygen or nitrogen, and exposure to air, oxygen or nitrogen and removal of the resulting surface compounds. The results of these experiments are discussed. (auth)

7755 BNL-2257

Brookhaven National Lab., Upton, N. Y.

INITIAL STUDIES ON THE EFFECT OF HIGH LEVEL GAMMA RADIATION ON CORROSION OF METALS. F. Hittman and O. A. Kuhl. [1954?]. 26p.

Preliminary data are presented from studies on the effects of high-level γ radiation on the corrosion of 24 ST aluminum in tap and distilled water at room temperature;

1020 mild steel in fused $NaNO_3$ at 350°C; copper in 2N HCl; and 1020 mild steel in 2N HCl. The corrosion test equipment used in the studies is described. (C.H.)

7756

PROTECTING MOLYBDENUM FROM OXIDATION. Alvin J. Herzig and James R. Blanchard (Climax Molybdenum Co. of Michigan, Detroit). Metal Progr. 68, No. 4, 109-14(1955) Oct.

The protection of Mo from oxidation at elevated temperatures by cladding, electroplating, metal spraying, and ceramic coating is reported. (J.E.D.)

GEOLOGY AND MINERALOGY

7757 RME-1050(Rev.)

Division of Raw Materials. Denver Exploration Branch, AEC.

RESULTS OF AN AIRBORNE RADIOMETRIC SURVEY IN THE CANON CITY EMBAYMENT AREA, COLORADO. A. L. Nash and L. J. Brown. June 16, 1954. 11p.

An airborne radiometric survey of the Dakota sandstone and Morrison formation in the Canon City embayment indicated the presence of new areas of anomalous radioactivity in the Dakota formation. One of the anomalies indicated a U deposit of possible economic importance. No anomalies were found in the Morrison formation or the Dawson Arkose. (J.E.D.)

7758 RME-1060

Division of Raw Materials. Denver Exploration Branch, AEC.

RECENT HIGH GRADE URANIFEROUS LIGNITE DISCOVERIES IN HARDING COUNTY, SOUTH DAKOTA. Lynn R. Burton. Jan. 24, 1955. 13p.

The first known deposits of commercial grade uraniferous lignites were discovered in Harding Co., S. Dakota. Significant tonnage of this material is found in the Cave Hills and Slim Buttes area. Trial lots of lignitic ore, assaying as high as 0.86% U_3O_8, were shipped to the ore buying station at Edgemont. The deposits are in both the Ludlow and Tongue River members of the Fort Union formation which crops out over a large part of Harding and Perkins Counties. Most of the uranium concentrated in the lignite exists as a urano–organic compound or complex. Metaautunite has been identified and other minerals may be present. Yellow carnotite-type minerals were found in sandstones of the Chadron formation and the Ludlow member of the Fort Union formation in the Slim Buttes area and in rocks which are thought to be part of the Arikaree formation in the West Short Pine Hills. A major part of both Harding Co. and Perkins Co. is considered favorable for prospecting. (auth)

7759 RME-2016(Pt.I)

Division of Raw Materials. Salt Lake Exploration Branch, AEC.

URANIUM OCCURRENCE AT THE KING NO. 1 CLAIM, GILA COUNTY, ARIZONA. PART I. Gerald Weathers. Aug. 1954. 12p.

The King No. 1 claim is staked along a northwest trending fissure vein in granite. This vein contains uranium occurring as aggregates of meta-torbernite crystals along minute fractures within quartz and altered muscovite granite. Similar veins are exposed southward to the end of the claim. The majority of these strike a few degrees north or south of west and dip steeply to the north, whereas the remainder strike northwest and dip steeply to the northeast. Projections of these veins suggest an intersecting vein system. Adit No. 2 has shown the vein to persist toward the southeast on the claim for at least 300 ft from its portal and to maintain an average strike of north 45° west and a dip of 65° to the northeast. This adit has prospected the vein from a depth of eight feet below the surface to a depth of 150 feet below the surface. Although no uranium ore has been encountered in the adit, the presence of meta-torbernite (regarded as a secondary uranium mineral) suggests the possibility of continued uranium mineralization below this zone. Radioactivity appears to be confined within the veins and has not been detected outside the vein zone. Present exposures of ore-grade material are confined to a near-surface zone Shaft A. Because of the occurrence of this uranium ore and the persistence of uranium mineralization within the vein, further exploration of the vein appears warranted. (auth)

7760 AERE-Lib/Trans-556

A MASS-SPECTROMETRIC METHOD OF MEASURING THE AMOUNT OF RADIOGENIC ARGON IN GEOLOGICAL FORMATIONS IN ORDER TO DETERMINE THEIR ABSOLUTE AGE. Kh. I. Amirkhanov, I. Gurvich, L. L. Shanin, S. S. Sardarov. Translated by V. Beak from Zhur. Tekh. Fiz. 25, 558-61(1955). 5p.

7761

STUDIES OF URANIUM MINERALS. XXI. SYNTHETIC HYDROGEN-AUTUNITE. Virginia Ross. Am. Mineralogist 40, 917-19(1955) Sept.-Oct.

Chemical analysis results, refraction data, and x-ray-diffraction data are presented. (J.E.D.)

7762

UNIT CELL DIMENSIONS OF URANINITE. Eleanor R. Berman (Harvard Univ., Cambridge, Mass.). Am. Mineralogist 40, 925-7(1955) Sept.-Oct.

7763

THE ARGON-40 CONTENT OF THE ATMOSPHERE AND THE AGE OF THE EARTH. H. A. Shillibeer and R. D. Russell (Univ. of Toronto, Canada). Geochim. et Cosmochim. Acta 8, 16-21(1955) Aug.

Applying the theory that the continents have been formed by the addition of volcanic material from depth during geologic time, and assuming that this material released all of its radiogenic A^{40} while it was in the molten state, an age of the earth has been calculated from the A^{40} content of the earth's atmosphere. Using current estimates of the potassium content of the crustal rocks, volume of the continents, and the A^{40} content of the atmosphere, we find that all the A^{40} in the atmosphere could have been released in this way if the earth were 5,300 million years old. This value is in reasonable agreement with other estimates of the age of the earth and of the universe. It is therefore concluded that this is a reasonable explanation for the derivation of the earth's atmospheric argon. (auth)

7764

RADIOACTIVE EQUILIBRIUM IN ANCIENT MARINE SEDIMENTS. Irving A. Breger (U. S. Geological Survey, Washington, D. C.). Geochim. et Cosmochim. Acta 8, 63-73(1955) Aug.

Radioactive equilibrium in eight marine sedimentary formations has been studied by means of direct determinations of uranium, radium, and thorium. Alpha-particle counting has

also been carried out in order to cross-calibrate thick-source counting techniques. The maximum deviation from radioactive equilibrium that has been noted is 11%—indicating that there is probably equilibrium in all the formations analyzed. Thick-source alpha-particle counting by means of a proportional counter or an ionization chamber leads to high results when the samples contain less than about 10 ppm of uranium. For samples having a higher content of uranium the results are in excellent agreement with each other and with those obtained by direct analytical techniques. The thorium contents that have been obtained correspond well to the average values reported in the literature. The uranium content of marine sediments may be appreciably higher than the average values that have been reported for sedimentary rocks. Data show that there is up to fourteen times the percentage of uranium as of thorium in the formations studied, and that the percentage of thorium never exceeds that of uranium. While the proximity of a depositional environment to a land mass may influence the concentration of uranium in a marine sediment, this is not true with thorium. (auth)

7765

LITHIUM RESOURCES OF NORTH AMERICA. James J. Norton and Dorothy McKenney Schlegel. U. S. Geol. Survey Bull. 1027-G, 1955. 27p. $0.15—paper cover (G.P.O.)

The United States and Canada have more than ample lithium resources to support the expanding lithium mining industry. The largest reserves are in the tin-spodumene belt of the Carolinas, which was first developed during World War II and is now the largest source of lithium in the world. Prior to World War II, deposits in S. Dak. were the chief source of lithium minerals, and these deposits still contain significant reserves. In Calif. lithium has been produced from Searles Lake brines since 1938, and during earlier years lepidolite was mined in the Pala district. Other states containing lithium deposits are N. Mex., Colo., Wyo., Conn., Me., and Mass. Canadian resources still are being developed. Significant deposits have not been reported elsewhere in North America. The earth's crust contains about 0.0006% lithium, or about 0.013% Li_2O. This is close to the grade of the Searles Lake brines, which contain 0.015% Li_2O. Pegmatite deposits, on the other hand, must contain 1.0% Li_2O order to be mined profitably. The most abundant lithium mineral occurring in pegmatites is spodumene. Other minerals include amblygonite, lepidolite, petalite, and triphylite-lithio-philite. These most commonly occur in mineral assemblages that are characteristic of inner zones and replacement bodies of pegmatites. Indicated reserves in the pegmatites of the U. S. are 5,000,000 units consisting of 20 lb. of Li_2O. By far the greatest reserves in pegmatites are in the Carolinas. Reserves in Searles Lake, Calif., may amount to 9,000,000 units. Inferred reserves in the United States and Canada are at least 125,000,000 units of Li_2O. In contrast to these figures, domestic consumption in 1953 was about 250,000 units. (auth)

7766

PHOTOGEOLOGIC MAP OF THE MOAB-16 QUADRANGLE, GRAND COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-83. W. R. Hemphill. Washington, U. S. Geological Survey, 1955. $0.50.

7767

PHOTOGEOLOGIC MAP OF THE MOAB-4 QUADRANGLE, GRAND COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-85. J. S. Detterman. Washington, U. S. Geological Survey, 1955. $0.50.

7768

PHOTOGEOLOGIC MAP OF THE MOAB-6 QUADRANGLE, GRAND COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-86. J. S. Detterman. Washington, U. S. Geological Survey, 1955. $0.50.

7769

PHOTOGEOLOGIC MAP OF THE TIDWELL-1 QUADRANGLE, GRAND COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-87. V. H. Sable. Washington, U. S. Geological Survey, 1955. $0.50.

7770

PHOTOGEOLOGIC MAP OF THE TIDWELL-3 QUADRANGLE, EMERY COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-88. C. H. Marshall. Washington, U. S. Geological Survey, 1955. $0.50.

7771

PHOTOGEOLOGIC MAP OF THE TIDWELL-8 QUADRANGLE, GRAND AND EMERY COUNTIES, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-89. V. H. Sable. Washington, U. S. Geological Survey, 1955. $0.50.

7772

PHOTOGEOLOGIC MAP OF THE ANETH-2 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-91. R. J. Hackman. Washington, U. S. Geological Survey, 1955. $0.50.

7773

PHOTOGEOLOGIC MAP OF THE ANETH-4 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-93. R. J. Hackman. Washington, U. S. Geological Survey, 1955. $0.50.

7774

PHOTOGEOLOGIC MAP OF THE ANETH-5 QUADRANGLE, SAN JUAN COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-94. R. J. Hackman. Washington, U. S. Geological Survey, 1955. $0.50.

7775

GEOLOGY OF THE HORSE RANGE MESA QUADRANGLE. GEOLOGIC QUADRANGLE MAP GQ-64. Fred W. Cater, Jr. Washington, U. S. Geological Survey, 1955.

A map of the geology of the Horse Range Mesa Quadrangle was made as part of a comprehensive study of carnotite deposits. The study included detailed examination of mines and geology of the quadrangle. Descriptions of geologic formations and general descriptions of regional structural setting, geologic history, and ore deposits are given. (J.E.D.)

7776

LEAD ISOTOPES AND THEIR SIGNIFICANCE. A. P. Vinogradov. p.320-61 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

The origin of different lead isotopes in ores and rocks and the possible mechanism of Pb distribution (and also of U and Th) in the earth's crust is considered. Attention is paid to the fact that Pb does not accumulate in the iron phase of meteorites (in particular according to the "Sikhote Alin" iron meteorite carried out by the author). For the first time determinations of the isotopic composition of

galena lead and of the lead of wall-rocks have been made. In all cases the lead of galena was older in isotopic composition than the rock lead. It was possible to compute the separation of the lead ores from these data. For instance, from the isotopic composition of the rock lead and of the galena lead from the Altai it appears that the time of the separation corresponds to the time of the whole tectonic-magmatic cycle, which took place about 280 million years ago. New data for 31 galenas of the Soviet Union are given. All known determinations of the isotopic composition of Pb from galena are summarized. The causes of the anomalies in the isotopic composition is considered apart. Out of all known data (more than 250 determinations) there are about 18 to 20% cases of anomalous lead composition. The fluctuation of U/Th ratio in rocks, the mixing and subsequent loss of Rn, U, and other products are believed to be the most important causes of anomalies. The causes exerting influence upon the Pb^{206}/U^{238}, Pb^{207}/U^{235}, Pb^{208}/Th^{232} and Pb^{207}/Pb^{201} ratios are considered in detail in connection with the determination of the age of minerals and rock according to these ratios. The isotopic composition of Pb according to age groups is given. The determination of rock age by the lead method is of exceptional importance for the determination of rock age and the separation of rocks of the Archean period comprising $^5/_6$ of the whole earth's history. (auth)

7777

APPLICATION OF RADIOACTIVE METHODS IN PROSPECTING. V. N. Dakhnov. p.229-52 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian).

The contemporary state of geophysical methods for the examination of section cuts, the technical state of wells, and new radioactive methods of investigation is discussed. A brief historical survey of the development of drill hole radiometry is then given, followed by a discussion showing the advantages of radioactive as compared to other methods. This in its turn is followed by a condensed description of the essence of the methods of natural gamma radiation, scattered gamma radiation, isotopes, neutron- and neutron-gamma methods, and the method of induced activity. The results of the main research and production practices carried out by various geophysical organisations of the Soviet Union, in the elaboration and improvement of different radioactive methods of well investigation are given. The paper concludes by stating the main premises predetermining the possibility of wide-scale application of the radioactive methods of drill hole investigation in the prospecting of other minerals besides oil and gas, such as boron and manganese. (auth)

7778

ON THE USE OF RADIOMETRY IN OIL PROSPECTING. F. A. Alekseev, A. P. Grumbkov, and Yu. E. Kirshfel'dt. p.253-66 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

Radiometric oil prospecting apparatus, designed and built by the Petroleum Institute of the USSR Academy of Sciences, is briefly described; the results of methodical investigations of the radioactivity of surface deposits are given, and some particular questions conducive to a general understanding of how radioactive anomalies arise are noted. The proposed radiometric method is simple, fast and cheap, which is of great practical importance to oil geology. In its general form, the proposed radiometric oil prospecting method consists of recording by special apparatus, the surface gamma radiation of the areas being explored. The paper describes stationary instruments for measuring α and γ radiation of rock and fluid samples, portable and lorry-mounted instruments for measuring surface soil gamma radiation intensity in the field, and investigations of the radioactivity of surface deposits of a number of oil fields in the Sovient Union. Field measurements are compared with measurements of radioactive samples taken from the same profiles. The comparison shows good coincidence of the radiometric curves. It is observed that the lower values of gamma-radiation intensity distinctly coincide with those of the oil bed roof. It is shown analytically that the radiation registered by the field instrument comes from the uppermost parts of the soil. The influence of the present relief and the lithological composition of the outcropping rocks on the distribution of the gamma radiation anomalies, when the basic deposits are close to the surface and the quaternary deposits are thin, is noted, and the necessity of making corrections connected with the above factors is pointed out. The radioactivity of oil and deep-lying water, and their possible influence on the distribution of the radioactivity of the soil surface layers are discussed. It is observed that the radioactivity of natural water depends on the chemical type of the water, its mineralization, the radioactivity of its surrounding rocks, and that there is a similarity in the geochemical conditions of the existence and preservation of highly radioactive waters and oil deposits. Theoretical considerations are given regarding the accumulation of radioactive salts in the surface deposits, due to oxidation of the deep water containing radium in easily soluble form, up to sulphates. The role of the hydrocarbon diffusion flux in the formation of radioactive anomalies in the surface layers of the soil is discussed. It is noted that the geochemical anomalies coincide with the reduction of the gamma-radiation value. Attention is drawn to the necessity of further investigations to ascertain the nature and mechanism of the formation of radiometric anomalies, and to develop methods of their interpretation. (auth)

7779

DIFFERENTIATION OF OIL-BEARING AND WATER-BEARING BEDS BY RADIOACTIVE METHODS IN CASED WELLS. A. I. Kholin. p.267-83 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

Determination of the nature of the bed fluid measured in a cased well is a major problem raised by the oil industry in recent years. This problem is most effectively solved by radioactive methods. The Gubkin Petroleum Institute, Moscow, has worked out and tested four different methods for determining the oil or water saturation of reservoir beds, based on measurement of thermal neutron density in the well, measurement of secondary gamma-radiation intensity, analysis of the spectrum of this gamma-radiation, and measurement of the gamma-activity of both parts of the bed (water and oil) after injection in the bed of a fluid containing some radioactive isotope and possessing the power of

permeating primarily one of the parts. The first three methods are based on the difference of the chlorine content in the oil and water. In the water bed the chlorine content reaches 10 to 15 g per 100 g of water. Due to the fact that chlorine has a much greater thermal neutron capture cross section than all the other elements of sedimentary rocks, and that in the capture of neutrons by the chlorine nuclei, up to three and more gamma quanta of up to 8.5 Mev are emitted per capture, the following is observed against the water bed, as compared with the oil bed: lower thermal neutron density, higher secondary gamma-radiation intensity, and enrichment of the secondary gamma-radiation with high-energy components. By observing the special measurement condition described in the paper, the above three methods yield a relative difference of 25% between the showings against the water and the oil beds. A ten-fold difference in artificial gamma activity of the water and oil parts of the bed may be achieved by the activated fluid injection method. Widely used in the industry today is the method based on the measurement of secondary gamma radiation intensity. (auth)

7780

THE POSSIBILITIES OF USING NEUTRON-INDUCED ACTIVE SODIUM FOR LOCATING OIL-CONTAINING AND WATER-CONTAINING LAYERS AND FOR DETERMINING WATER-OIL CONTACTS IN DRIVE-PIPE WELL CONDITIONS. N. K. Kukharenko, V. P. Odinokov, and Yu. S. Shimelevich. p.284-301 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

The sodium activation method is used to locate oil- and water-bearing beds. The method was tested in laboratory conditions and in oil fields. It uses neutron-induced activity for analyzing the composition of rocks. A theoretical analysis shows that the sodium found in the bed waters is the tracer element, with the aid of which it is possible to distinguish mineralized water beds from oil-saturated beds. This is possible due to the relatively long half life of radioactive sodium (15.1 hours), and the high energy of its gamma-radiation (2.75 Mev). In laboratory conditions, the magnitude of activation of a mineralized water-bearing bed exceeded by 3 to 5 times the activation of an oil-bearing bed. So far, a relatively small volume of investigation has been conducted in the oil fields. The paper contains the results of investigations in two wells. Measurements were made with a scintillation counter. Investigations were conducted by points. Very high-intensity neutron sources were used for irradiation of the rocks. Immediately after irradiation by neutrons, a very high induced activity with a half life of the order of three hours is observed opposite the oil-bearing and water-bearing beds; however, 13 hours after irradiation, the position of the water-oil contact was clearly defined. It should be noted that the readings opposite the water-bearing part of the layer exceeded 4 to 5 times those opposite the oil-bearing part. In another case, an analysis was made of water-bearing and oil-bearing beds found separate; two-fold differences were obtained. The paper proposes a broad field test of the method in various geological conditions, and suggests ways of considerably cutting down the investigation time. (auth)

7781

POSSIBILITIES FOR EXTENDING THE USE OF RADIOACTIVE RADIATIONS IN OIL PROSPECTING AND OIL FIELD DEVELOPMENT. G. N. Flerov and F. A. Alekseev. p.302-19 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

Radiometric methods open up wide possibilities for the solution of new highly important problems connected with oil and gas prospecting and development. These methods include: determination of the location of the water-oil contact in the bed by measurements in cased wells; control of the displacement of the water injected in the bed in bottom and edge flooding; determination of the location of oil levels in well sections under investigation; qualitative determination of the oil saturation of the bed; more comprehensive study of the geological section and the physical parameters of productive wells. Of particular importance are investigations to determine the possibility of applying radiometry in oil prospecting. Control of water-oil contact displacement in oil field operation can be effected by the use of the inductive activity method as well as by modifications of the neutron gamma-logging (NGL) and the neutron logging (NL) methods. These are based on the considerable difference in the mineral salt, and primarily the chlorine content in the formation water and oil. Theoretical estimations and experiments show that the NGL difference against the oil and water beds is 5 to 20% in cases when the lithology and porosity of the bed are uniform and the formation water has a high mineral content. Particular attention is devoted to the diffusion of chlorine, or chlorine-containing salts, in the cement ring, and to providing a means of expelling the fluid from the well in the zone of the instrument during the measurement of the thermal neutron flux, by using the NL method. The most reliable results were obtained by the method of inductive sodium activity. Owing to sodium activation, the inductive activity of water-bearing beds exceed the inductive activity of the oil bed by several times. Attention is drawn to the necessity of applying activation analysis in investigating well sections, and of using small-sized accelerators for creating a neutron flux. A method of controlling the direction and velocity of the formation water injected in edge flooding, is based on the use of the radioactive tritium isotope H^3. Investigations have begun in recent years to determine the possibility of using radiometric methods in oil prospecting. (auth)

METALS AND METALLURGY

7782 AD-35278

[National Research Corp., Cambridge, Mass.]

RESEARCH ON THE EFFECTS OF HYDROGEN, OXYGEN, NITROGEN AND CARBON ON THE PROPERTIES OF WELDS IN TITANIUM. Quarterly Report No. 2 for the Period December 10, 1953 to April 15, 1954. John L. Ham. Apr. 21, 1954. 9p. NRC Project No. 4465. Contract AF33(616)-2228.

The results are presented of chemical analyses on various ingots, bars, sheets, and H-treated welding blanks. Experiments in the addition of H indicated that the time interval necessary to attain equilibrium with a calculated mixture of A and H was excessively long even at 900°C. The H-treating temperature will be reduced to between 680° and 700°C in order to keep the grain size comparable

to that of the other samples. A consumable electrode-type melting furnace permitted the addition of O, N, and C in a more precise manner than that of remelting sheet heated in O or N or sprayed at 900°C. The new procedure resulted in an ingot containing 0.251% C, whereas the calculated value was 0.28%; this was considered satisfactory. (ASTIA abst.)

7783 ERI-2076-5-P

Michigan. Univ., Ann Arbor. Engineering Research Inst.
INTERMEDIATE TEMPERATURE CREEP AND RUPTURE BEHAVIOR OF TITANIUM AND TITANIUM ALLOYS. Quarterly Progress Report No. 8 Covering the Period from March 1, 1955 to May 31, 1955. J. V. Gluck and J. W. Freeman. May 31, 1955. 15p. Contract AF 33(616)-244, Supplemental Agreement No. 89(55-1113).

A study was made of the effects of structure, contaminants, and hardness on elevated temperature properties of Ti alloys. For these studies, a vacuum annealing and hydrogenation furnace was designed in order to effect the control of H. Operation and calibration of the furnace is described. Limited data are presented on a study of cold working on the 1000°F properties of an α alloy, Al-Si-Ti. (auth)

7784 NP-5772

Illinois Inst. of Tech., Chicago.
A STUDY OF CONTROLLED ATMOSPHERES FOR THE HEAT TREATMENT OF ALLOYS STEELS. Final Summary Report (Technical Report No. 5) [for] June 23, 1952–September 15, 1955. Dept. of Metallurgical Engineering. Fred Kisslinger. 34p. DA Project No. 5B99-01-004. Contract DA-11-022-ORD-993.

Work done to determine equilibrium conditions between Co–CO_2 atmospheres and alloy austenites is presented. Equilibrium conditions have been determined for various CO–CO_2 atmospheres and nickel alloy austenites at 800 and 1000°C. The nickel concentrations cover the range up to 5%. Some data have also been obtained for chromium alloy austenites at 800°C. Chromium concentration also varied up to 5%. (auth)

7785 NP-5777

Clevite Research Center, Cleveland.
DEVELOPMENT OF TITANIUM POWDER PRODUCTION. Final Report. Alan J. Hatch, Edward P. Weber, and Arthur D. Schwope. Sept. 30, 1955. 42p. Contract DA-33-019-ORD-1467, Phase I.

Three methods that have been investigated for powdering Ti were ball milling, Wiley milling, and crushing of hydrided Ti sponge. The preparation of Ti powder and feed material from Ti scrap by hydriding sponge, comminuting, and dehydriding appears to be feasible. The 6% Al–4% V–90% Ti alloy and other Ti alloys have been synthesized by powder metallurgical methods. (C.W.H.)

7786 WADC-TR-54-175(Pt.1)

Michigan. Univ., Ann Arbor. [Engineering Research Inst.]
NOTCH SENSITIVITY OF HEAT-RESISTANT ALLOYS AT ELEVATED TEMPERATURES. PART I. PRELIMINARY STUDIES OF THE INFLUENCE OF RELAXATION AND METALLURGICAL VARIABLES. Howard R. Voorhees and James W. Freeman. Aug. 1954. 110p. Contract AF18(600)-62. (AD-45580)

The factors affecting notch sensitivity of heat-resistant alloys under sustained loads at elevated temperatures were tested. The investigation was based on the belief that varied response to notches must be related to relaxation characteristics of alloys at service temperature. A procedure was proposed whereby the history of representative fibers in a notched specimen would be followed to the point of rupture. Data from other sources comparing strengths for smooth and notched bars of materials of interest are included. Additional data required for the proposed analysis were obtained under the present program for three alloys with conventional heat treatments: S-816 at 1350°F, Waspaloy at 1500°F, and Inconel X-550 at 1350°F. Test results included stress-rupture time properties, short-time tensile properties, and creep properties when stresses were changed from one level to another during a test. Relaxation characteristics were measured for initial stresses both below and above the proportional limit. The notch strengthening observed for S-816 and Waspaloy, and the notch weakening for Inconel X-550 at the test temperatures has been satisfactorily explained in terms of comparative relaxation and stress-rupture time characteristics, though further work is indicated before a quantitative correlation is attempted. Tests were conducted to determine the effect of some metallurgical variables on the notched bar rupture test characteristics. Cold working had the greatest effect on notch sensitivity of the several conditions investigated, but no severe case of notch weakening was observed for either S-816 at 1350° and 1500°F, or for Waspaloy at 1500°F in the limited number of tests. (auth)

7787 WAL-401/84-55

Illinois Inst. of Tech., Chicago. Armour Research Foundation.
SURFACE HARDENING OF TITANIUM WITH METALLOID ELEMENTS. Final Technical Report [for] June 1, 1953–May 31, 1955. A. Siede and Verne Pulsifer. 101p. DA Project No. 593-08-021. ARF Project No. B-056-0. Contract DA-11-002-ORD-1319.

This investigation centers on obtaining such a surface by the infusion of metalloid elements into titanium. The surface produced by a nitriding treatment meets the requirements of being hard, wear resistant, and antigalling. The nature of the hard surface formed by nitriding and the infusion of both oxygen and nitrogen, and the effects of these treatments on growth and distortion, surface roughening and mechanical properties of the material were investigated. The hardness and wear resistance of the nitrided surface are very high compared to the untreated material, but the depth of hardening produced by nitriding appears small for many applications. The introduction of oxygen as a hardening agent in conjunction with nitrogen increases the case depth attainable, but at the same time increases the brittleness of the hard surface formed during treatment. Nitriding causes definite size changes to occur in the part being treated. The magnitude of the size change depends on the alloy being processed as well as the specific treatment employed. Nitriding also seems to cause a considerable amount of surface roughening depending on the specific alloy being processed. The effects of nitriding on the mechanical properties of the alloy are, in general, to increase the tensile and yield strength and notch sensitivity of the material. The surface hardening processes satisfy the requirements for producing a hard, wear-resistant, and antigalling surface on titanium and its alloys. The limitations of the nitriding treatment can only be evaluated by field testing of nitrided parts. (auth)

7788 WAL-401/143-11

Brown Univ., Providence. [Barus Research Lab. of Physics].

CORROSION AND PASSIVITY STUDIES OF TITANIUM. Final Technical Report [for] July 1, 1952–September 30, 1955. Dept. of Physics. H. E. Farnsworth, R. E. Schlier, and T. H. George. Sept. 30, 1955. Includes a reprint: ION BOMBARDMENT-CLEANING OF GERMANIUM AND TITANIUM AS DETERMINED BY LOW-ENERGY ELECTRON DIFFRACTION. H. E. Farnsworth, R. E. Schlier, T. H. George, and R. M. Burger. J. Appl. Phys. 26, 252-3[1955]. 94p. DA Project No. 599-01-004. Contract DA-19-020-ORD-1816.

The distinguishing features of physical and chemical adsorption are discussed. It is concluded that chemisorption must be studied under non-equilibrium conditions and, therefore, that the sticking probability and rate of desorption are the preferable variables for experimental observation. The low-energy electron diffraction method is compared with the flash filament technique and the field emission microscope method as means of making such observations. The dynamic theory of electron diffraction is discussed and the failure of the approximations for the case of low-energy electrons is noted. The apparatus and procedures are described with emphasis on recent and projected improvements. Finally, the experimental results are presented and discussed. Copper was deposited by evaporation in a controlled manner upon the (00.1) face of a titanium single crystal. Low-energy electron diffraction is used to investigate the structure of the deposit. Before making any deposit, the titanium crystal is cleaned by thorough outgassing followed by argon ion bombardment and annealing. The deposit is found to be in the form of oriented crystallites, with (111) copper planes parallel to the (00.1) titanium plane, and (110) copper planes parallel to the (11.0) titanium planes. The lattice constant of the deposit, in directions parallel to the substrate, is found to be that of bulk copper. The low-energy electron diffraction apparatus, with no change except in external circuitry, was used to measure secondary electron emission yields. The outgassed titanium surface has a maximum yield of 0.74 at 210 ev primary electron energy. The positive ion bombarded surface has a maximum yield of 0.70 at 180 to 260 ev primary energy, and the clean (ion-bombarded and annealed) surface has a maximum yield of 0.73 at 200 ev. The titanium surface covered with 32 atomic layers of copper has a maximum yield of 0.91 at 450 to 650 ev, as compared with the accepted value for bulk copper of 1.26 at 600 ev. After prolonged heating of a titanium crystal in high vacuum slightly below the transition temperature, the surface was found to be covered with a stable compound of undetermined structure. This structure was removed by suitable bombardment with positive argon ions, but the underlying crystal lattice was disarranged. Subsequent thermal annealing restored the lattice structure, and resulted in a clean crystal surface without altering the exposed (0001) crystal face. (auth)

7789 WAL-401/203-5

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

DEVELOPMENT OF TITANIUM-BASE ALLOYS OF HIGH STRENGTH AND TOUGHNESS. Interim Technical Report No. 4 for September 1 to December 31, 1954. C. R. Lillie. Aug. 2, 1955. 17p. Project No. B-059. Contract DA-11-22-ORD-1428.

The mechanical properties of Al–Mn–Ti, Al–Ni–V and of other binary, ternary and quaternary alloys of high strength and toughness were studied at a range of tensile strength from 75,000 to 200,000 psi with emphasis on the development of strength above 150,000 psi. The $\alpha/\alpha+\beta$ transus temperatures of Al–Si–Ti systems are shown. (For preceding report in series see WAL-401/203-4). (J.E.D.)

7790 WCRT-TN-53-178

Wright Air Development Center. Materials Lab., Wright Patterson AFB, Ohio.

CONFERENCE ON FUSION WELDED TITANIUM PRODUCTION PARTS FOR B-36 AIRCRAFT. J. N. Siltanen. Sept. 3, 1953. 6p. (AD-38202)

A report of a conference to discuss the problems involved in determining acceptance standards for fusion-welded Ti parts in the B-36 aircraft is presented. (auth)

7791 AEC-tr-2259

ON THE PROBLEM OF THE ACTIVATION OF METAL SURFACES. Cyrill Schaub and Werner Liedske. Translated by Gabriele Wohlauer from Z. Metallkunde 44, 570-2 (1953). 6p.

The qualitative agreement between the decrease in electron emission and the photographic effect of a deformed metal surface gives rise to the assumption that the same elementary process is the cause for both effects. That the blackening effect is at least not caused by electrons alone, is shown with an experiment during which an electrical field is applied during the exposure of the photographic plate. The difference in blackening between an exposure in an accelerating field and an opposing field is small. The portion of the blackening which cannot be influenced by electrical fields is contributed by H_2O_2 which is produced by the chemisorption of oxygen in moist atmosphere. Under the action of this chemisorption, Kremer's electrons are emitted from the metal simultaneously. (auth)

7792 AEC-tr-2261

THE USE OF C^{14} FOR THE STUDY OF DIFFUSION OF CARBON IN STEEL. P. L. Gruzin, V. G. Kostogonov, and P. A. Platonov. Translated by Steven J. Rothman from Doklady Akad. Nauk S.S.S.R. 100, 1069-72(1955). 5p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-4203.

7793 AEC-tr-2262

AN INVESTIGATION OF THE DIFFUSION OF IRON IN IRON–NICKEL ALLOYS. M. B. Hyman and A. Ya. Shinyaev (Shinyayev). Translated by Steven J. Rothman from Doklady Akad. Nauk S.S.S.R. 102, 969-72(1955). 5p.

The diffusion coefficients of Fe in Fe–Ni alloys have been measured at various alloy compositions and temperatures. The diffusion coefficients were found to vary smoothly with the alloy compositions. Energies of activation were also determined. (C.W.H.)

7794 AEC-tr-2263

THE STUDY OF DIFFUSION OF IRON IN IRON–MOLYBDENUM ALLOYS. M. [B.] Hyman and A. Ya. Shinyaev (Shinyayev). Translated by Steven J. Rothman from Doklady Akad. Nauk S.S.S.R. 103, 101-4(1955). 5p.

The diffusion coefficients of Fe in Fe–Mo alloys have been measured over a wide range of alloy compositions and temperatures. Marked changes in the diffusion coefficients were observed at alloy compositions where compound formation had been reported. Activation energies were also determined. (C.W.H.)

7795 AEC-tr-2265

THE DETERMINATION OF THE DIFFUSION COEFFICIENT ON THE BASIS OF THE ABSORPTION OF BETA RAYS. A. A. Zhukhovitski[i] and V. A. Geodakyan. Translated by Steven J. Rothman from Doklady Akad. Nauk S.S.S.R. 102, 301-4(1955). 5p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-5670.

7796

EQUILIBRIUM DIAGRAMS OF CERTAIN SYSTEMS ON PLUTONIUM BASES. S. T. Konobeevskii. p.362-76 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

By applying different research methods (metallographic, x-ray-diffraction, thermal, etc.) worked out for quantities ranging from 10 micrograms to 100 milligrams of a metal the binary diagrams of plutonium with a number of metals were studied. This paper describes briefly some of the properties of metallic plutonium. Given here is a thermographic recording of six plutonium phases and the magnetic susceptibility curve as a function of temperature. (auth)

7797

RESULTS OF IRRADIATION EFFECTS ON DIFFUSION OF SILVER IN LITHIUM. V. K. Zavoiskii and B. V. Ershler. p.362-8 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

A study of the effects on the metallic lattice of Li of thermal neutron irradiation and consequent formation of He and T fragments led to measurements of the rate of diffusion of pile-activated Ag foil into unirradiated Li at 16, 100, and 150°C and into Li irradiated in a neutron flux of 10^{13} neutrons/cm^2/sec. The resulting data are plotted and correlated with diffusion laws. (G.Y.)

7798

THE METALLURGY OF ZIRCONIUM. NATIONAL NUCLEAR ENERGY SERIES, DIVISION VII, VOLUME 4. Benjamin Lustman and Frank Kerze, Jr., eds. New York, McGraw-Hill Book Co., Inc., 1955. 776p. $10.00.

The following topics are discussed: the various uses of Zr and its application to nuclear reactors, geographic occurrence and reserves, production processes including the iodide decomposition process, and the melting, shaping, joining, finishing and physical metallurgy of Zr and its alloys. Phase studies and the metallography of various Zr alloy systems are also included. Mechanical properties, corrosion, analytical chemistry, metallurgy, industrial hygiene and safety are covered in detail. (J.E.D.)

7799

INVESTIGATION OF MIXING PROCESSES IN OPEN-HEARTH FURNACE BATHS WITH AIR OF RADIOACTIVE ISOTOPES. A. I. Osipov, L. A. Shvartsman, V. E. Iudin, and M. L. Sazonov. p.29-47 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

The investigation was made with radioactive cobalt. A method of studying the phenomena of mass transfer in the molten metal of the bath of a large-capacity, open-hearth furnace was developed. Kinetic curves have been obtained that characterize the change of concentration of a small dose in a fixed point of the body of the bath. An analysis of these curves made it possible to establish the time necessary for a uniform distribution of radiocobalt in the body of the liquid metal. In the case of a 350-ton open-hearth furnace and with the tracer introduced through the middle charging window, it fluctuates between 8 and 15 minutes, depending upon the speed of carbon oxidation. When the tracer is introduced through one of the extreme charging windows the calculated time for the radioisotope to effect a uniform concentration is about 40 to 45 minutes. The coefficients of turbulence diffusion in a metal bath have been calculated from experimental data. They are of the order of 400 to 1000 cm^2/sec. A quantitative connection has been found between the speed of carbon oxidation and the values of the coefficients of turbulence diffusion. Experimental data show that the mechanisms of mass and heat transfer in molten metal during intensive "boiling" of the bath are identical. Convective currents having speeds of up to 100 meters per hour have been found in the body of the metal. Such currents are caused by the asymmetry of the thermal work of the furnace. (auth)

7800

INVESTIGATION OF NON-METALLIC INCLUSIONS BY RADIOGRAPHY. S. M. Gnuchev and V. G. Kuklev. p.69-78 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

A radioactive calcium isotope was used in a study of the effect of the pouring method on the distribution of non-metallic inclusions in the ingot. For this purpose powdered calcium oxide or silicate containing the radioactive isotope was added to the steel while pouring. The particle size of the powder varied mainly between 16 and 40 microns. A study was made of the distribution of the inclusions in the ingot caused by the first portions of the metal, entering in the mould inclusions which get into the ingot while it is being bottom or top poured, and of those which enter it during after-teeming the top of the ingot. The distribution of the inclusions in the ingot was investigated by contact autoradiography control of the surface of longitudinal specimens cut from 75- and 800-kg ingots. For the autoradiograms the Soviet "XX" grade film was used. In some cases the data obtained by analysis of the radiograms were corroborated by counting the activity of precipitates of the non-metallic inclusions electrolytically isotated from the metal with a counter of the Geiger-Müller type. Analysis of the autoradiograms showed that in both pouring methods — bottom and top pouring — mainly the bottom part of the ingot is contaminated, and that the contamination is greater in the case of after-teeming. Radioactive inclusions which were brought into the ingot during after-teeming were found also in the top of the ingot. Under equal conditions of contamination of the incoming metal with radioactive inclusions less inclusions were found when the metal was bottom poured than when it was top poured. Autoradiograms show that a considerable part of the active inclusions remains in the central runner. During bottom pouring part of the radioactive inclusions were carried into the surface of the ingot due to the movement of the metal in the mould under the action of the rising stream. (auth)

7801

ISOTOPE EXCHANGE METHOD FOR MEASURING THE VELOCITY OF EVAPORATION AND THE COEFFICIENT OF DIFFUSION OF SOLID METALS. An. N. Nesmeyanov, N. F. Lebedev, V. I. Lozgachev, and E. G. Chudinov. p.79-100 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

A method of measuring the velocity of evaporation (n_0) and the self-diffusion coefficient (D) is described, based on isotope exchange between two samples of a substance placed in a vacuum chamber, one of these samples containing a radioactive isotope. The isotopic exchange of molecules between the surfaces of the two samples and diffusion of these molecules into the samples results in the radioactive isotope passing from the first sample into the second. The velocity of this transition may be described by solving the diffusion equation for the border and initial conditions following from the physical picture of the exchange. It is shown that arrangement of the samples with their surfaces facing one another, and in the same plane, results in different isotope transition velocities, and in all the equations the velocity of evaporation should be replaced by double its value. Calculation formulas are given in the report, and the experimental procedure employed for isotopic exchange is described. The experimental results showed this newly developed method to be quite suitable for measuring the velocity of evaporation, and the coefficient of diffusion. (auth)

7802

METHODS OF INVESTIGATING DIFFUSION WITH RADIOACTIVE ISOTOPES. A. A. Zhukhovitskii. P.101-14 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

Diffusion measurements are important for the production of new alloys with prescribed properties, and for the development of the diffusion theory. The first part of the paper discusses three alternatives of an absorption method of measuring the diffusion coefficient, which do not require determination of the absorption characteristics. The theory of dimensions leads to the conclusion that in ordinary diffusion experiments the annealing times (t_1 and t_2), corresponding to different temperatures (T_1 and T_2) to the same relative reduction of the radiation value, are connected by the relation $t_1D_1 = t_2D_2$, where D_1 and D_2 are the diffusion coefficients at the temperatures T_1 and T_2. This relationship permits determination of the activation energy of the diffusion process. The thin-layer method consists in measuring the radiation intensity of the opposite sides of a thin slab (I_1 and I_2), when a radioactive substance is deposited on one of the sides. Theory leads to the relationship $\ln I_1 - I_2/I_1 + I_2 = \ln K - mt$, whereby the diffusion coefficient can be calculated. Here t is the annealing time, K depends only on the absorption and scattering characteristics, and m only on the diffusion coefficient ($m = \pi D/l^2$), and l is the slab thickness. The "thick-layer" method is based on measurement of the intensity of radiation emitted by a sample with uniformly distributed activity and asymptotic relationship valid for high t and underlying the usual absorption method of measuring D. The paper describes a graphic method for the simultaneous measurement of diffusion and thermodynamic characteristics by studying the kinetics of isotopic exchange between the two slabs. Experimental material on the checking of all the methods is cited, and the values and sources of errors are discussed. (auth)

7803

INVESTIGATIONS OF THE WEAR OF CUTTING TOOLS WITH THE HELP OF RADIOACTIVE ISOTOPES. E. P. Nadeinskaya. p-140-64 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

A study has been made of the resistance to wear of mineral ceramics. The optimum working conditions have been established for different tool materials on various kinds of jobs. A relationship and mathematical equations have been found making it possible to plot the well-known wear resistance curves; i. e., the connection between the new method and the usual micrometric method has been established. It should be noted that the radioactive isotope method in no way eliminates the use of the micrometric method of investigation. The geometry of wear of the tool cutting surfaces, required to set up resharpening schedules, can be determined only by the micrometric method. The radioactive isotope method in combination with the micrometric method provides an utmost solution of practical problems in the investigation of cutting processes, simultaneously permitting profound elucidation of the nature of wear of the cutting tool materials. The results achieved in the search for a new method of investigating the resistance to wear of tools by employing radioactive isotopes recommend this method as an express-method for wide use in metal cutting laboratories at plants and institutes. (auth)

7804

IONIZATION METHODS FOR DETERMINATION OF DEFECTS OF THICK SECTIONS OF METAL BY GAMMA-RAYS. I. G. Fakidov and A. A. Samokhvalov. p.165-81 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

A description is given of work connected with making ionization gamma instruments for testing thick metal parts. The advantages of the use of counters in gamma defectoscopy are: higher sensitivity, higher test speed, the possibility of constant control of a moving part, the cut in cost due to the fact that X-ray film and other photographic materials are not used. The instrument consists of the following main parts: a gamma radiation direction device, a mechanical and electric-power portion for moving the gamma-ray beam system with respect to the part being tested, and the recording portion. The most convenient gamma source for testing parts of thickness 250 to 300 mm is the Co-60 isotope. For thicknesses of steel from 70 to 100 mm, use may be made of isotope Ir-134 or Ir-192, though the latter is less convenient because of its small half life of 2.5 months. The gamma counter in the instrument was either a scintillation counter or a self-extinguishing gas-filled counter. An investigation of the properties of the gamma instrument showed a considerable influence of the parameters of the geometric scheme of the instrument

on its sensitivity. An optimum instrument was selected on the basis of experiments in which changes were made in the dimensions of the container, the channel diameter of the container, the size of the counter screen, the diameter of the counter screen window and the relative positions of the source, the part being tested and the counter. The problem of the correspondence between the size of internal defects and the heights of the peaks on the defectograms registered by self-recording potentiometers was clarified. The sensitivity of the instrument depends on the control conditions. In the case of parts with a small difference of wall thickness, the sensitivity may reach a fraction of a percent. With respect to parts of thickness up to 300 mm, and of complex form with a large difference of wall thickness, the sensitivity of an instrument with a self-extinguishing counter permits location of defects up to 3% in the case of a slightly active source (1.5 curies). An instrument with a scintillation counter has a sensitivity 2 to 3 times greater (1-1.5%). The control speed in the case of complex-form parts with a large difference of wall thickness is 30 cm^2/min. The control result is recorded on the defectogram. With parts of the same thickness, the control speed may be increased several times. The possibility of using a new detector of gamma radiation (a crystal of cadmium sulphide together with phosphorus) is also reported. This detector was studied in the laboratory. (auth)

7805

MEASURING THICKNESS AND DENSITY WITH THE AID OF RADIOACTIVE ISOTOPES. A. M. Bogachev, B. I. Verkhovskii, and A. N. Makarov. p.182-99 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

The connection has been studied between the error of thickness measurement, the radiation absorption coefficient in the material being tested, and the activity of the radiation source. The results obtained permit a rational choice of radioactive isotopes and source activity in problems of thickness measurement using the absorption method. A compensation method of measuring the flux of radioactive radiation has been worked out. This method is based on the use of an auxiliary source, the radiation flux of which is automatically attenuated by a diaphragm to a value at which equality of both fluxes is reached. An apparatus has been designed and built for continuous automatic measurement of the thickness of a sheet of steel during production in the rolling mills. One type of instrument is designed for measuring thicknesses of from 5 μ to 150 μ. The radioactive isotope Tl^{204} (activity 10 mc) is used as the radiation source. A second type of instrument is used for measuring steel thicknesses from 50 μ to 1 mm. The radiation source is the isotope Ce^{144} (activity 5 mc). The maximum measurement error of these instruments does not exceed ±1.5% of the thickness being measured. Instruments of a third type are designed for measuring thicknesses from 2 mm to 10 mm. The radiation source is the isotope Ir^{192} (activity 5 mc). The maximum measurement error of the third-type instrument does not exceed ±50μ, when the material being tested is in a fixed position. In production conditions, the maximum error amounts to ±0.18 mm due to vertical movement of the steel sheet in the rolling mill. The measurement time of the instruments is 0.1 sec. This apparatus is used at a number of ferrous metallurgical plants. A similar measurement method and apparatus are used for continuous automatic control of the thickness of tin coating on a steel during its production. The intensity of the scattered β radiation of Tl^{204} is measured. The source activity is 40 mc. The measurement range of the thickness of the coating is 0 to 5μ. The maximum error does not exceed ±0.1 μ. (auth)

7806

EXPERIENCE IN THE INDUSTRIAL USE OF ISOTOPES FOR BRANDING ROLLED STEEL. V. A. Yanushkovskii. p.200-9 in Meetings of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

The peculiarities of the production of cold-rolled strip steel render it impossible to employ the usual mechanical, magnetic, electrochemical and other methods of branding. The method best suited to these conditions of production is the radioactive method. Methods of applying the radioactive substances to the surface of the strip steel are enumerated. Questions connected with the selection of the composition of the radioactive electrode are elucidated. A method of calculation is given for determining the relation between the amount of radioactive substances applied in the first operation and the guaranteed registration of this brand in the last control operation with a minimum total consumption of radioactive substance. The problem of improving the efficiency of registration of the brands is discussed. The possibilities of employing radioactive branding in a number of other branches of industry are noted. (auth)

7807

PROBLEMS IN THE SCIENCE AND PHYSICS OF METALS. III SYMPOSIUM OF THE PROCEEDINGS OF THE INSTITUTE OF SCIENCE AND PHYSICS OF METALS. Metallurgizdat, 1952. (In Russian) (Book on display at Geneva Conference)

Studies of the nature and mechanism of open-hearth transformations, the influence of alloying elements on the decomposition of austenite, the secondary hardening of alloyed steels, the strengthening and weakening of steels due to deformation. Application of radioactive isotopes in the investigation of diffusion and self-diffusion in metals and alloys and in the study of the distribution of the elements between the metal and the slag. (publisher's note)

7808

QUALITY CONTROL OF METALS BY γ-RAYS. S. V. Rumyantsev, Yu. A. Girgorovich. Metallurgizdat, 1954. (In Russian) (Book on display at Geneva Conference)

Physical and technical fundamentals of γ defectoscopy of metals with the use of radioactive isotopes, methods and technique of γ ray examination of ingots, welded and cast articles. Shielding and safety engineering in γ defectoscopy. Part I. Brief data on radioactivity, the nature and properties of γ rays and radioactive substances employed in the γ ray examination of metals. Description of the phenomena accompanying the passage of α, β, and γ rays through substance. Part II. The photographic method of revealing defects in metals and its field of application—exposures used and the sensitivity of the method; a detailed account of the general procedure, the technique and methods of quality control of industrial objects: ingots, welds, castings of all kinds, and the determination of the geometrical shape and dimensions of machine parts (assemblies) hidden from sight by means of γ ray photographs. Autoradiography and

examination of metals with the aid of γ rays and with electrons freed by γ rays. Part III. Principles of the ionization method of revealing defects and measuring the thickness of metals and pipe wall discrepancies with the aid of γ and β rays. Part IV. Labor protection in γ defectoscopy, calculation of the thickness of the shielding material and the safety distance, calculation of the amount of radioactive isotopes required and instructions for shielding the premises in which γ defectoscopy is carried out. (publisher's note)

7809

INDUSTRIAL GAMMA-DEFECTOSCOPY. L. K. Tatochenko and S. V. Medvedev. Moscow, Metallurgizdat, 1955. (In Russian) (Book on display at Geneva Conference)

A manual for industrial examination of metallic articles by γ rays from radioactive cobalt and iridium isotopes. Description of equipment employed in defectoscopy in the photographic and ionization methods. Methods of dosimetry of γ radiation, experience in the use of γ defectoscopy at the plant; organization of labor in γ defectoscopy and safety engineering. (publisher's note)

7810

INFLUENCE OF SPECIMEN AREA ON THE PITTING PROBABILITY OF ALUMINUM. P. M. Aziz and Hugh P. Godard (Aluminium Labs. Ltd., Kingston, Ontario, Canada). J. Electrochem. Soc. 102, 577-9(1955) Oct.

The pitting probability of 2S aluminum was determined in Kingston tap water as a function of area, for areas ranging in size from 0.06 cm^2 to 243 cm^2. The pitting probability was found to vary uniformly with area, from 0.001 to 1 as the area increased from 0.06 cm^2 to 60 cm^2; extrapolation indicated that the pitting probability becomes zero at an exposed area of about 0.055 cm^2. This work supports the contention that pitting sites in aluminum are not specific macrodefects in the metal surface, but rather arise in a random fashion through the interaction of myriads of anodic and cathodic elements on the metal surface. (auth)

7811

AIR INJECTION FOR PREVENTION OF HYDROGEN PENETRATION OF STEEL. W. A. Bonner and H. D. Burnham (Shell Oil Co., Wood River, Ill.). Corrosion 11, 447t-53t(1955) Oct.

The use of very small amounts of air for the prevention of hydrogen attack leading to blistering and fissuring of equipment is described. This protection is achieved by producing a small amount of polysulfide in situ which converts cyanide to thiocyanate and inhibits the primary corrosion reaction. The method has been used successfully for about two years. Inspections have failed to show any hydrogen damage to equipment protected by adequate air injection; no degradation of product quality has been observed. In the application of the method, a number of problems arose which have since been solved. These difficulties include: 1) accumulation of oxygen in stagnant vapor areas, 2) accumulation of acidic ammonium thiocyanate leading to high corrosion rates, 3) control of pH in the desired range to prevent deposition of ammonium salts and to prevent decomposition of ammonium polysulfide, and 4) limited reaction rate between oxygen and hydrogen sulfide to form polysulfide. Several methods are considered for the control of air injection to meet the polysulfide requirement in the system. Hydrogen penetration probes and chemical spot tests for ferrocyanide and free cyanide have been found adequate for this purpose. Complete protection against hydrogen damage has been attained by only infrequent adjustment of the air injection rates. (auth)

7812

475°C EMBRITTLEMENT OF CHROMIZED COATINGS ON LOW CARBON STEEL. W. L. Chu (General Electric Co., Pittsfield, Mass.). J. Metals 7, 1121-3(1955) Oct.

It was observed that chromized coatings on low carbon steel could be embrittled by cooling slowly through the 475°C range. A higher chromium coating was more susceptible to embrittlement than a lower chromium coating. Coating structure and composition could be correlated with the chromizing process and prior carbon content of the steel. (auth)

7813

ISOTHERMAL DECOMPOSITION KINETICS OF TRANSFORMED-BETA PHASE IN A TITANIUM–NICKEL ALLOY. D. H. Polonis (Univ. of Washington, Seattle) and J. Gordon Parr (Univ. of Alberta, Edmonton, Canada). Acta Met. 3, 307-11(1955) July.

The decomposition kinetics of the transformed-β phase during isothermal heat treatment has been studied by measuring the rate of precipitation of Ti_2Ni. The reaction follows the type of equation suggested by Johnson and Mehl, and an activation energy of 84,000 cal/mole has been determined. On the basis of the values of the coefficient "n" it is suggested that Ti_2Ni precipitates as plates at temperatures up to 525°C. Above this temperature there appears to be a tendency for the formation of spheroidal precipitates. A model for the reaction is proposed in which the rate controlling process is the self-diffusion of titanium. (auth)

7814

THE HEATS OF FORMATION IN THE SYSTEMS TITANIUM-ALUMINIUM AND TITANIUM–IRON. O. Kubaschewski and W. A. Dench (National Physical Lab., Teddington, England). Acta Met. 3, 339-46(1955) July.

A calorimeter has been constructed for the determination of exothermic heats of alloying. The heats of formation of iron-aluminium alloys determined with this apparatus agree closely with those obtained by Oelsen and Middel using quite a different method. The heats of formation of FeTi and in the Ti-Al system were also measured, but with Fe_2Ti and Ti-Sn alloys reaction was incomplete. A few representative heats of formation in kcal/g-atom are shown. The probable errors are discussed and estimated to be of the order of 1.5 to 2.5%. Using the heats of formation of the Ti-Al alloys, and the free energies in the Ti-O system previously determined, the possibility of producing Ti-Al alloy from TiO_2 and excess aluminium has been discussed, and it was found that alloys containing up to 43% Ti could be made relatively free of oxygen. (auth)

7815

A GROWTH MECHANISM FOR MERCURY WHISKERS. G. W. Sears (General Electric Research Lab., Schenectady, N. Y.). Acta Met. 3, 361-6(1955) July.

Very fine whiskers of solid mercury can be grown by condensation of mercury vapor on a glass surface. It is demonstrated that the whiskers have a single imperfection, an axial screw dislocation, which accounts for their morphology. The whiskers are nucleated on tiny crystalline regions in the glass surface which present the end of a screw dislocation. (auth)

7816
A MECHANISM OF WHISKER GROWTH. G. W. Sears (General Electric Research Lab., Schenectady, N. Y.). Acta Met. 3, 367-9(1955) July.

Fine whiskers of zinc, cadmium, silver, and cadmium sulfide have been grown on pyrex and quartz glass substrates by vapor deposition. The maximum supersaturation ratio at which whiskers can be grown is in good correspondence with the calculated supersaturation at which two-dimensional nucleation occurs. This correspondence offers support for the generality of the growth mechanism first proposed for mercury whiskers. (auth)

7817
HOW COMMERCIAL TITANIUM AND ZIRCONIUM WERE BORN. W. J. Kroll. J. Franklin Inst. 260, 169-92(1955) Sept.

The development of methods and procedures for the commercial production of Ti and Zr is outlined. A detailed discussion is presented of the Kroll method for Ti production. (C.W.H.)

7818
NEW METHOD FOR SOFT SOLDERING METALS AND CERAMICS. J. C. McGuire (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 26, 893(1955) Sept.

A new friction-tinning soft soldering method is described in which a hand grinder fitted with an abrasive head and loaded with a soft solder is employed. The heat of friction generated by the grinder melts the soft solder which flows evenly onto the metal surface. The technique was found effective on every metal tested. (B.J.H.)

TRACER APPLICATIONS

7819
USE OF RADIOACTIVE ISOTOPES IN METALLURGY. SYMPOSIUM XXXIV. I. N. Kidin, ed. Metallurgizdat, 1955. (In Russian) (Book on display at Geneva Conference)

Researchers using radioactive isotopes. Theoretical papers on the study of diffusion and self-diffusion in alloys, the mechanism of oxidation, the kinetics and distribution equilibrium of various elements among the phases, thermodynamic characteristics of the components of liquid and solid solutions. Methods of studying the changes of diffusion and thermodynamic characteristics and of determination of the vapour pressure; papers on alloy analysis. Some of the articles contain the results of investigations of metallurgical plants (blast, open-hearth and electric furnaces) with the use of labelled atoms. (publisher's note)

PHYSICS

7820 ACSIL/Liby-4
Gt. Brit. Admiralty Centre for Scientific Information and Liaison, London.
A BIBLIOGRAPHY OF LITERATURE RELATING TO BARIUM TITANATE. Oct. 1951. 22p.

7821 K-1234
Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.
CALCULATION OF TRANSIENT LOAD STABILITY OF AN ELECTRICAL SYSTEM. J. E. Rowe. Sept. 23, 1955. 17p. Contract W-7405-eng-26.

The equations and the method of their solution for the transient load stability of electrical systems are discussed. The features of the IBM Type 650 Calculator which allow for the automatic solution of large systems and minimize time and cost are compared with other methods of calculation. Approximation of differentials and the effect of the time interval are also discussed. (auth)

7822 NP-5776
Lehigh Univ., Bethlehem, Penna. Inst. of Research.
PROPAGATION OF ELASTIC AND PLASTIC DEFORMATIONS IN SOLIDS. Final Report [for] August 28, 1954 to August 27, 1955. C. W. Curtis. Includes Appendix I: RATE OF STRAIN AND ITS EFFECT ON THE PROPAGATION OF A PLASTIC STRAIN PULSE IN LEAD. B. E. K. Alter and C. W. Curtis. 43p. Project TB 2-0001(187). Contract DA-36-034-ORD-1456, Suppl. 1.

The propagation of strain pulses along solid bars was investigated. The pulse was produced by applying a time-dependent compressive force to one end of a freely suspended bar or system of bars. With the condition of loading specified, the resulting strain as a function of position and time was determined. (J.E.D.)

7823 NYO-7475
Franklin Inst. Labs. for Research and Development, Philadelphia.
PROBLEMS RELATED TO BOUNDED ARRAYS OF DISTRIBUTED CHARGES. R. S. Smith and F. E. Jaumot, Jr. Oct. 1955. 36p. Contract (30-1)-1484.

A method for an approximate calculation of the potential and field at any point, due to a bounded array of charges, is developed. The principal features of the method are that it retains the geometric features of the array and allows the atom to have a finite volume, comparable to the volume of the region of interest. The value of the method lies in its applicability to finite crystals. A brief review of previous work is given and a simple application of the method outlined. (auth)

7824 UCRL-3103
California. Univ., Berkeley. Radiation Lab.
AN OCCLUDED GAS ION SOURCE. Richard B. Crawford, James D. Gow, Wing G. Pon, and Lawrence Ruby. Aug. 1955. 23p. Contract W-7405-eng-48.

An occluded gas pulsed ion source has been developed in which the hydrogen to be ionized has been previously absorbed by the arc electrode material. The principal advantages of the source are high output and economy in gas flow. The plasma is formed when a discharge is made to occur between alternate elements in a sandwich of insulators and hydrogenated titanium. The source has been adapted to both axial and radial extraction. Large beam currents, i.e. 1.5 amp per square inch of emitting area at 10 kv, are obtained in either case. The output has been magnetically analyzed and the ratio of atomic to molecular ions has been found to be high, but the major fraction of the total current consists of ions heavier than hydrogen. Reasons are given for believing that neutral hydrogen is released from the discharge points of the metal and is subsequently ionized. Steps in hydrogenating the metal are described. (auth)

7825
PREPARATION OF THIN COATINGS WITHOUT SUPPORT. P. Prugne, J. Blandin-Vial, A. Godin, G. Lechauguette, and P. Leger (C.E.N. de Saclay, France). J. phys. radium 16, 730-1(1955) Aug.-Sept. (In French)

A method is described for dissolving the plastic supports

upon which films of various materials have been deposited. Films of 15 elements, ranging in thickness from 3 to 400 $\mu g/cm^2$, have been obtained. Some of the difficulties encountered are discussed. (B.J.H.)

7826

ON THE SCATTERING CROSS SECTION OF AN OBSTACLE. D. S. Jones (Univ. of Manchester, England). Phil. Mag. (7) 46, 957-62(1955) Sept.

Van de Hulst's theorem giving the relation between the scattering cross section and the scattered 'amplitude' for an incident plane wave is derived by a calculation of the energy flow. In addition it is shown that, when the incident wave is due to a point source, the sum of the scattering and absorption cross sections is determined by the value of a certain field in the neighborhood of the source. The argument, which is based on energy considerations, could be applied to many scattering problems, e.g. sound waves or atomic collisions but is given explicitly for the electromagnetic field. (auth)

7827

IONIC AND NUCLEAR PROBLEMS OF ROCKET PROPULSION. Francis J. Murray (Columbia Univ., New York). IRE Convention Record 3, Part 10, 35-6(1955).

Passenger carrying vehicles which can attain a satellite status around the earth, are usually thought of as rocket propelled. However, a solution to the problem of air resistance by ionic controlled air flow may permit the development of high-speed air vehicles. The energy requirements may also induce a change in the current developments in nuclear power. (auth)

7828

ON THE MECHANISM OF THE PHOTOGRAPHIC ACTION OF X-RAYS. Jordan Malinowski (Institute of Physics, Academy of Science, Sofia, Bulgaria). Z. Physik. Chem. (Leipzig) 204, 276-85(1955) Aug. (In English)

It is shown that the mean energy ϵ_0 which an emulsion grain ought to absorb in order to become developable can be determined from sensitometric data. The values obtained in this way for several commercial emulsions, exposed to x radiation of effective wavelength 0.12 A, show that ϵ_0 is of the same order of magnitude for all investigated emulsions, in spite of their wide difference in light sensitivity and specification. The experimental results indicate further that ϵ_0 is greater for the coarser grained emulsions, increasing approximately proportionally to the third root of the average mass of the emulsion grains. The dependence of ϵ_0 on the geometrical dimensions of the emulsion grains, and not on their sensitivity towards light, is explained in view of the experimental evidence that the latent image formed by x rays is found to be dispersed throughout the entire volume of the emulsion grains. (auth)

7829

SESSION OF THE ACADEMY OF SCIENCES OF THE U.S.S.R. ON THE PEACEFUL USE OF ATOMIC ENERGY. JULY 1-5, 1955. MEETINGS OF THE DIVISION OF PHYSICAL-MATHEMATICAL SCIENCES. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

Separate abstracts were prepared for the 21 papers compiled in this book.

COSMIC RADIATION

7830

COSMIC RAYS. N. Dobrotin. Moscow, Gostekhizdat, 1954. 320p. (In Russian) (Book on display at Geneva Conference)

Fundamentals of cosmic ray physics. Qualitative descriptions of cosmic ray phenomena. An introduction to the study of cosmic rays. Detailed bibliography (over 400 references). (publisher's note)

7831

RAYS FROM THE DEPTHS OF THE UNIVERSE. G. B. Zhdanov. Moscow, Gostekhizdat, 1953. 128p. (In Russian) (Book on display at Geneva Conference)

A popular booklet on cosmic rays, the study of which has led to the solution of a great number of complicated problems in physics. The discovery and investigation of cosmic rays, the discovery of hitherto unknown particles of matter (positron, mesotrons); the discovery of new properties in known particles, and the penetration of science into the secrets of atomic structure, as a result of these investigations. (publisher's note)

7832

FURTHER OBSERVATIONS OF COSMIC-RAY EVENTS IN NUCLEAR EMULSIONS EXPOSED BELOW GROUND. E. P. George (Univ. of Sydney, Australia) and J. Evans (Messrs. Standard Telephones, London). Proc. Phys. Soc. (London) A68, 829-35(1955) Sept. 1.

Earlier work with underground emulsion has been extended by making observations at greater depths, and by obtaining more data at depths previously employed. The final result for the interaction cross section of fast μ mesons with nucleons is $(4.6 \pm 0.5) \times 10^{-30}$ cm^2. The flux of fast π mesons is certainly less than 0.17% of the flux of fast μ mesons, and a more probable figure for this ratio is 0.04%. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

7833 IDO-16237

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

REFLECTIVITY OF CALCITE FOR THERMAL NEUTRONS. M. W. Holm. Sept. 1, 1955. 14p. Contract AT(10-1)-205.

Twenty-four calcite planes are examined with a view towards determining their suitability for use in the MTR Crystal Spectrometer. Interplanar spacings are tabulated for each of these planes and the structure factor and Debye-Waller correction factor are calculated for the first three orders in each case. Relative reflectivities as a function of glancing angle are shown graphically for a few representative planes. (auth)

7834 AEC-tr-2264

THE DEPENDENCE OF THE CRITICAL SHEAR STRESS FOR TWINNING AND SLIP IN CRYSTALS OF CADMIUM ON THE SPECIMEN DIAMETER. E. S. Yakovleva and M. V. Yakutovich. Translated by Steven J. Rothman from Zhur. Eksptl'. i Teoret. Fiz. 10, 1146-50(1940). 7p.

The critical stress for twinning, T_t, and for slip, T_s, of Cd crystals of diameter 0.09 to 0.7 mm have been measured. With a decrease of crystal diameter to 0.1 mm a significant increase (about 9 times) of the stress for twinning and a lesser (about 2 times) increase of the stress for slip were found. A qualitative explanation of the observed dependence of T_t and T_s on the crystal diameter is given. (auth)

7835

X-RAY SCATTERING EFFECTS DUE TO LOCALIZED STATIC LATTICE DEFECTS. Charles W. Tucker, Jr. and

Peter Senio (Knolls Atomic Power Lab., Schenectady, N. Y.). Phys. Rev. 99, 1777-81(1955) Sept. 15.

Theoretical calculations by Huang show that elastic singularities in a crystalline lattice should produce four specific x-ray scattering effects which include diffuse scattering and an artificial temperature factor. All four of the effects are present in neutron-irradiated crystals of boron carbide, diamond, silicon carbide, and magnesium oxide. Thus the model and calculations of Huang are qualitatively confirmed. It is suggested that it may be possible to determine more precisely the nature of the lattice distortions around localized static lattice defects from a detailed study of the diffuse scattering. (auth)

7836

NOMOGRAPHS FOR THE DETERMINATION OF WAVELENGTH FOR HIGHEST ANGLE X-RAY DIFFRACTION. L. Muldawer and R. Feder (Frankford Arsenal, Philadelphia). Rev. Sci. Instr. 26, 827-9(1955) Sept.

A single operation technique is presented for the determination of wavelength for highest angle diffraction of cubic materials. This method makes use of a chart with the lattice parameter as ordinate and $(\lambda/2\sin\theta)$ as abscissa, lines being drawn for each $(h^2+k^2+l^2)$. For noncubic materials, a chart is prepared with lattice spacing as ordinate and $(1/\sin\theta)$ as abscissa, lines being drawn for each wavelength. Separate settings must be made for each spacing in this second case. (auth)

ELECTRICAL DISCHARGE

7837 AEC-tr-2280

CONCENTRATION OF METASTABLE ATOMS IN THE POSITIVE COLUMN OF A DISCHARGE AT LOW PRESSURES. Yu. M. Kagan and V. I. Perel. Translated from Zhur. Ekspti'. i Teoret. Fiz. 24, 319-25(1953). 8p. Available from Associated Technical Services (Trans. 58G6R), East Orange, N. J.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-6227.

ELECTRONS

7838

ATOMIC NEGATIVE-ION-PHOTODETACHMENT CROSS-SECTION AND AFFINITY MEASUREMENTS. Stephen J. Smith and Lewis M. Branscomb. J. Research Natl. Bur. Standards 55, 165-76(1955) Sept.

The spectral distributions of the H^- and O^- cross sections for photodetachment have been measured. The H^- measurements are consistent with the theory of Chandrasekhar. A curve has been fitted to the results for O^-. The threshold of this cross section, the affinity of O^-, is found to be 1.48 ± 0.10 electron volts. No evidence is found for resonance at the threshold or for the existence of excited O^- ions. The apparatus is described in detail. (auth)

GASES

7839 KAPL-1375

Knolls Atomic Power Lab., Schenectady, N. Y.

DIFFUSION OF GASES THROUGH METALS. II. DIFFUSION OF HYDROGEN THROUGH POISONED PALLADIUM. W. D. Davis. Apr. 1, 1955. 54p. Contract W-31-109-Eng-52.

The effect of temperature, pressure, and prior treatment on the permeability of palladium to hydrogen was studied. Treatment with oxygen and hydrogen increased the permeability, while exposure to organic compounds greatly decreased the permeability. The permeability of palladium was proportional to the square root of the pressure when clean and to the first power of the pressure when poisoned. The activation energy for the permeability of poisoned palladium was not constant; values ranging between 4 and 10 kcal per mole were obtained. Electrical resistance measurements of the palladium during diffusion showed the poisoning to be a surface effect, and hydrogen concentrations at the front and back surfaces were calculated. Measurements of rates of absorption of hydrogen by palladium at room temperature after various treatments showed that the large variations in rate were probably caused by surface poisoning also. The chief contaminant responsible for poisoning appears to be hydrocarbons. The permeability at 400°C as a function of pressure, degree of poisoning, and direction of diffusion was calculated by assuming that the impurity atoms occupy some of the adsorption sites on the palladium and blocks the adsorption of hydrogen on these sites. The calculated permeability-pressure relationship is similiar to the observed relationship. (auth)

7840 NACA-TN-3270

National Bureau of Standards, Washington, D. C.

EFFECT OF DISSOCIATION ON THERMODYNAMIC PROPERTIES OF PURE DIATOMIC GASES. Harold W. Woolley. Oct. 15, 1954. 19p.

A graphical method is described by which the enthalpy, entropy, and compressibility factor for the equilibrium mixture of atoms and diatomic molecules for pure gaseous elements may be obtained and shown for any dissociating element for which the necessary data exist. Results are given for hydrogen, oxygen, and nitrogen. The effect of dissociation on the heat capacity is discussed briefly. (auth)

7841

ON THE USE OF PALLADIUM DIFFUSION MEMBRANES FOR THE PURIFICATION OF HYDROGEN. D. W. Juenker, M. van Swaay, and C. E. Birchenall (James Forrestal Research Center, Princeton, N. J.). Rev. Sci. Instr. 26, 888(1955) Sept.

Observations on the physical properties and permeability characteristics of Pd at temperatures up to 500°C are reported. Below 400°C, with no grain growth observable, the permeability was found to increase with temperature initially, subsequently falling asymptotically to a stable level. A lower temperature limit is set by the growth of the relatively impermeable β phase. This effect becomes noticeable at about 160°C. Repeated passage through the β transformation with a H_2 atmosphere, and the presence of nonuniform heating and cool zones in the sample is considered to be responsible for the embrittlement and disintegration of Pd tubes which has been noted by other observers. Successful soldering of Pd barriers to Kovar tubes sealed in glass was achieved, using pure Ag as a solder. At 300 to 400°C, 100 liters of H_2 were passed through a barrier over a period of 6 mos., without leakage or brittle failure. (K.S.)

7842

SECOND APPROXIMATION TO THE THERMAL DIFFUSION

FACTOR ON THE LENNARD-JONES 12:6 MODEL. S. C. Saxena and B. N. Srivastava (Indian Association for the Cultivation of Science, Calcutta). J. Chem. Phys. 23, 1571-4(1955) Sept.

Several collision integrals useful for the calculation of the second approximation to the thermal diffusion factor have been evaluated for the Lennard-Jones 12:6 model and utilized to calculate $[R_T]_2$, the second approximation to the thermal separation ratio from the expressions developed by Mason for the exp-six model. It has been shown that the difference between $[R_T]_1$ and $[R_T]_2$ for the 12:6 model is very small and does not vitiate the method developed by us elsewhere for calculating the force constants from the thermal diffusion data. These considerations have been applied to argon and the results compared with the experimental data. A simple empirical relation connecting $[R_T]_1$ and $[R_T]_2$ has been derived for the Lennard-Jones 12:6 model. (auth)

7843

INTERMOLECULAR POTENTIALS OF ARGON, KRYPTON, AND XENON. E. Whalley and W. G. Schneider (National Research Council, Ottawa, Canada). J. Chem. Phys. 23, 1644-50(1955) Sept.

The intermolecular potentials of A, Kr, and Xe are investigated using the recently measured second virial coefficients and the crystal properties at 0°K. The potential functions considered are the 9:6, 12:6, and exp:6. The methods of determination of parameters are reviewed and the method of least squares is described. All the potentials fitted the second virial coefficient very well, but with the same parameters fitted the crystal properties only moderately well. (auth)

INSTRUMENTS

7844 AERE-ED/R-1671

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A SIMPLE, AIR BEARING, ROTOR FOR VERY HIGH ROTATIONAL SPEEDS. A. G. Montgomery and Frank Sterry. July 19, 1955. 10p.

A high speed rotor (of diameter $\frac{3}{4}$") is capable of 250,000 rpm driven by an air turbine; it runs on air lubricated, externally supplied journal bearings, which consist of standard, sintered, oil-retaining bronze bushes (with the oil extracted). For purposes of sealing and flexibility, they are mounted on rubber 'O' rings. The thrust bearing is a single air jet 0.020" diam in the middle of a flat surface. The rotor is a plain, ground cylindrical rod of tool steel with serrations milled at one end to provide a crude turbine wheel-running at a diametral clearance of about 0.003". Bearing air consumption is about 10 cfm. The system could be made much smaller, both to achieve higher speeds and to economize in air consumption. (auth)

7845

AUTOMATIC OSCILLOGRAPH READERS. Louis L. Fisher and George L. Hatchett (J. B. Rea Co., Inc., Santa Monica, Calif.). IRE Convention Record 3, Part 10, 112-16(1955).

Techniques and designs for automatically reading oscillograph records are described. (B.J.H.)

7846

ANALYSIS OF DATA RECORDING SYSTEMS. Thomas L. Greenwood (Redstone Arsenal, Huntsville, Ala.). IRE Convention Record 3, Part 10, 117-23(1955).

Systems for both digital and analog data recording systems are discussed. The functions of the six elements composing all systems are analyzed on a fundamental basis. (B.J.H.)

7847

MECHANICAL DEVICE FOR PRODUCING DENSITY GRADIENTS IN LIQUIDS. Norman G. Anderson (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 26, 891-2(1955) Sept.

ISOTOPES

7848

THE CHEMISTRY OF ISOTOPES. A. I. Brodskiĭ. Moscow, Akademiya Nauk S.S.S.R., 1952. 352p. (In Russian) (Book on display at Geneva Conference)

A systematization of the material on the physical and chemical properties, methods of investigation, means of producing and occurrence of isotopes, published in scientific literature up to 1951. Application of isotopes in chemical analysis and in the investigation of technological processes, the strength of the bonds between atoms and molecules, and the mechanisms of chemical reactions and biological processes. (publisher's note)

7849

RADIOACTIVE ISOTOPES. A. N. Nesmeyanov. Moscow, Znaniye, 1955. 32p. (In Russian) (Book on display at Geneva Conference)

The discovery of radioactive elements, their properties; methods of production and application in modern scientific research in industrial engineering and agriculture. A brief description of designs of apparatuses for the production of radioactive isotopes. Bibliography for readers wishing to extend their knowledge on this subject. (publisher's note)

7850

PRODUCTION OF RADIOACTIVE ISOTOPES. A. N. Nesmeyanov, A. V. Lapitskiĭ, and N. P. Rudenko. Moscow, Goskhimizdat, 1954. 193p. (In Russian) (Book of display at Geneva Conference)

The principles and methods of production of radioactive isotopes, table of isotopes and their properties, according to data published up to January 1, 1954. Decay diagrams of the majority of radioactive isotopes. (publisher's note)

7851

ISOTOPES. Harmon Craig (Institute for Nuclear Studies, Chicago) and Giovanni Boato (Istituto Fisico dell' Universitá, Genova, Italy). Ann. Rev. Phys. Chem. 6, 403-32(1955).

A critical review and evaluation of current research in geochemistry and chemical kinetics are presented. Research on the isotope effects in chemical and phase equilibria was also reviewed. (C.W.H.)

MASS SPECTROGRAPHY

7852 AERE-G/M-50

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A GAS HANDLING SYSTEM SUITABLE FOR USE WITH A MASS SPECTROMETER. G. H. Palmer. Apr. 1950. 6p.

A gas handling system is described which is made of glass and where the gas is controlled with Hg cut-off valves. The system is suitable for use with a mass spectrometer and a very simple gas leak described which connects the glass system to a spectrometer. (auth)

MATHEMATICS

7853 NARF-55-12T

Consolidated Vultee Aircraft Corp., Fort Worth, Tex.

SOLID ANGLE CALCULATIONS. E. L. Secrest. Apr. 28, 1955. 32p. Contract AF 33(038)-21117. (MR-N-77)

The problem of solid angle calculations is treated in a systematic fashion for sphere and disk geometries. Rigorous expressions are developed for the solid angle subtended by a sphere at a point and by a disk at a point. Approximate expressions are also developed in such a way as to demonstrate the range of their applicability. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

7854 DP-129

Du Pont de Nemours (E. I.) and Co. Savannah River Lab., Augusta, Ga.

IODINE STACK MONITOR. B. M. Carmichael and D. G. Karraker. Aug. 1955. 7p. Contract AT(07-2)-1.

An instrument for continuously monitoring radioiodine in a flowing caustic solution was assembled for use with a stack monitoring system. An absolute counting efficiency of 3.2% was obtained. (auth)

7855 NAA-SR-1137

North American Aviation, Inc., Downey, Calif.

ABSOLUTE THERMAL NEUTRON DETERMINATION. PART II. ABSOLUTE BETA COUNTING OF INDIUM FOILS. Roscow L. Koontz, Moses A. Greenfield, and Alan A. Jarrett. Oct. 1, 1955. 35p. Contract AT-11-1-GEN-8.

Correction factors for the effect of thickness on the self-scattering, self-absorption, and backscattering of beta particles from indium foils have been determined. Foils from 0.03 to 100 mg/cm^2 were prepared on essentially weightless backings and activated by irradiation in a standard geometry in a solution nuclear reactor. The activated foils were counted in a 2π windowless proportional flow counter and in a standard end window GM detector with and without a thick backing of silver. The data were corrected for the fraction of activity which was produced by epithermal neutrons, the self-shielding of thermal neutrons by the foil during irradiation, the small contribution by the backscatter from the foil support, and the contributions of gamma and x rays to the counting rate. The multiple beta spectra of indium produced a minimum in the self-absorption and self-scattering correction curve in the GM detector at about 1 mg/cm^2 of sample and a maximum at about 12 mg/cm^2 of sample. This is due to the balancing of the effects of self-absorption and preferential forward scattering in the narrow geometry GM detector. The self-absorption curve for indium in the 2π counter has the expected shape for a beta emitter with multiple spectra. The self-scattering and self-absorption correction factors for a 100 mg/cm^2 indium foil are approximately 1.5 for a GM detector at 7% geometry and about 3 for a 2π counter. (auth)

7856 UCRL-4556

California. Univ., Livermore. Radiation Lab.

A CONTINUOUS ALPHA AIR MONITOR COMPENSATING FOR THE NATURAL ATMOSPHERIC RADIOACTIVITY. David R. Sawle. Aug. 24, 1955. 26p. Contract W-7405-eng-48.

An instrument has been built and tested which, when placed in a room containing α activity, will under most conditions give a positive indication that activity is present by the time the operator has received one half the maximum permissible daily dose of uranium or, if the activity stems from Pu, five times the maximum daily dose. Under many conditions it will give a positive indication sooner. It operates on the principle that when air is drawn through a filter paper, the Rn daughters reach equilibrium after a short time, and upon reaching equilibrium, 94% of the α emitted are 7.68 Mev. By discriminating electronically between these and the lower-energy, longer-lived activity, it is possible to build a continuous α air monitor with a fast response and good sensitivity. (auth)

7857

PROPORTIONAL COUNTER WITH A Be SHELL FOR THE DETECTION OF FAST NEUTRONS. Yves Koechlin (Centre d'Etudes Nucleaires de Saclay, France). J. phys. radium 16, 707-8(1955) Aug.-Sept. (In French)

The design of a Geiger-Mueller counter used for the detection of cosmic neutrons is described. A study of its characteristics and the measurements made show that in the proportional region, this counter permits discrimination of fast neutrons from γ and cosmic rays. Its quantum yield is of the order of 8×10^{-5} for neutrons of about 50 Mev. (tr-auth)

7858

PRINCIPLES OF DOSIMETRY OF IONIZING RADIATIONS. K. K. Aglintsev. Moscow, Medgiz, 1954. (2nd edition) (In Russian) (Book on display at Geneva Conference)

A popular manual on Dosimetry for physicians and biologists treating on the physical characteristics and laws of interaction between x and γ rays with substances, and on the fundamentals of ionizing radiation dosimetry. The manual explains the operating principles of dosimeters. The concluding part deals with x- and γ-ray shielding. (publisher's note)

7859

IONIZATION METHODS OF INVESTIGATION. V. Veksler, L. Groshev, and B. Isaev. Moscow-Leningrad, Gostekhizdat, 1950. 427p. (In Russian) (Book on display at Geneva Conference)

Part I. Ionization chambers for α, β, γ, and cosmic radiations, chambers for neutrons and pulse chambers. Part II. Counters of charged particles, the theory of their operation and corrections for separate counters. Proportional counters (for fast particles and neutrons) and counters with individual discharges (non-self-extinguished and self-extinguished). (publisher's note)

7860

ROENTGENOMETRY. I. V. Porolkov. Moscow-Leningrad, Gostekhizdat, 1950. 383p. (In Russian) (Book on display at Geneva Conference)

Physico-technical principles and practical methods of x-ray and γ-radiation measurements. The physics section deals with the absorption and dispersion of x and γ rays and the secondary processes caused by them. The practical section contains data on methods and means of measurement and on x-ray shielding. Reference data given. (publisher's note)

7861

THE USE OF A SCINTILLATION COUNTER FOR RADIOMETRIC APPARATUS IN THE OIL INDUSTRY. B. G. Erozolimskii and D. F. Bespalov. p.320-37 in Meetings

of the Division of Technical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 339p. (In Russian)

At the present time discharge counters are used in serial-produced apparatus for radioactive logging, and also in apparatus for measuring the radioactivity of rock samples as gamma-radiation indicators. The use of a scintillation counter for such purposes opens up new possibilities for solving many problems in the oil industry. A very important advantage of the scintillation counter is that it permits spectroscopy of the gamma radiation under investigation. New experimental instruments designed for radiometric investigations under industrial conditions are described. The LS-2-type apparatus is used for gamma and neutron-gamma logging of oil wells. The apparatus consists of a well-instrument and a control panel located in an auto-laboratory. The following are situated in the well-instrument: a photo-electronic multiplier with a CsI crystal, a galvanic battery supply for the multiplier and electronic circuits, with the aid of which amplification, formation, and amplitude pulse discrimination is carried out. The wiring of the apparatus, which is described in detail, ensures stability of the readings within several percent. During two hoistings in the well, the instrument allows for the taking of four gamma radiation intensity curves corresponding to four different energy cut-offs of gamma quanta. Tests made with this instrument in industrial conditions showed that the radiolog curves thus obtained have a considerably greater differentiation than curves taken by a serial instrument with discharge counters. The apparatus as a whole proved sufficiently reliable and simple in operation. At present, an industrial model of this apparatus is being developed for serial production. The LS-1 unit for measuring the gamma activity of samples of rocks, waters, and oils is designed for laboratory investigations, and consists of a photomultiplier with a CsI crystal, a recording electronic circuit, and a current source. Test samples of about 200 g are placed in a special container that fits tightly over the crystal. The crystal and sample together are then placed in a lead housing. Using this arrangement, investigation of rock samples with an average gamma activity takes 10 to 15 min.; measurement accuracy is 7 to 10%. A brief description is given of an apparatus for measuring the alpha activity of rock samples. A coating of zinc sulphide made directly on the glass of the photomultiplier is used as scintillator. Sample measurements are taken in 30 min to two hours, depending upon their activity. The background of the apparatus is 4 to 6 counts/hr. The use of such apparatus in the oil industry offers great posibilities. (auth)

7862

A BENT CRYSTAL NEUTRON SPECTROMETER WITH QUARTZ MONOCRYSTAL. YU. G. Abov. p.294-305 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

A transmission type bent crystal neutron spectrometer with a quartz monocrystal, using the neutron beam of an experimental heavy water reactor, is described. The spectrometer is similar to the X-ray spectrometer developed by Cauchois. A multiple slit system was used in order to work at small angles without interfering with the direct neutron beam. This slit system was located inside the channel in the reactor shield. It was manufactured of sheets of cadmium. The collimated neutron beam falls upon the (10$\bar{1}$0) or (13$\bar{4}$0) planes of a large quartz monocrystal and the diffracted beam was detected by means of a BF_3 proportional counter. The crystal slab was bent by applying two equal opposite directed moments to the ends of the slab. The resolution power of a spectrometer at 1 ev energy equals 3.3%. The neutron cross sections of a number of isotopes were investigated in the energy interval 0.03 to 2 ev. The results of the investigation of the energy dependence of the total cross section of Pu are given, showing the possibilities of the neutron spectrometer. The following parameters of the 0.3 ev resonance level of Pu^{239} were obtained: E_0 = 0.300 ± 0.005 ev; Γ = 0.124 ± 0.002 ev; and σ_0 = 4500 ± 400 barn. For the 1.075 ev resonance level of Pu^{240} the following parameters were obtained: E_0 = 1.075 ± 0.005 ev; Γ = 0.042 ± 0.005 ev; and σ_0 = 178000 ± 16000 barn. The cross-section corresponding to the thermal energy E_n = 0.025 ev equalled, according to the results of our work, σ = 1050 ± 13 barn. The transmission of the Pu sample used at 0.3 ev being very small, the measurements were repeated with the aid of a cyclotron, using a thin plutonium sample. The following results were obtained for the 0.3 ev level: E_0 = 0.300 ± 0.005 ev; Γ = 0.105 ± 0.005 ev; and σ_0 = 4600 ± 300 barn. In addition to this, the results of the measurements of the energy spectrum of the neutrons emerging from the reactor are given. It is shown that the difference of the temperature of the neutrons and the moderator is around 40 to 50°C. (auth)

7863

DOSIMETRY OF IONIZING RADIATIONS WITH THE AID OF INFRARED STIMULABLE PHOSPHORS. V. V. Antonov-Romanovskii, I. B. Keirim-Markus, M. S. Poroshina, and Z. A. Trapeznikova. p.342-61 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

A method of γ dosimetry is given in which infrared stimulated phosphors are used. The dose of γ radiations is determined by the brightness of the infrared-induced luminescence flash of γ ray excited phosphors. The most suitable is the phosphor SrS-Eu,Sm with deep trap levels and good excitability by hard radiations. The deep trap levels cause long time light sum accumulation up to 40°C, which makes it possible to apply this phosphor for dosimetry. The minimum dose registered is 0.005 r, the maximum is 1000 r. When the dose is more than 0.5 r, 2 to 3 readings may be made. The time for determining a dose is ~0.5 min. Readiness of action is constant. Dosimeters may also be applied to the β-ray registration, and to measurements of thermal neutron flux, when the dosimeters are placed in cadmium envelopes. (auth)

7864

MODIFICATIONS TO THE HUTCHINSON-SCARROTT PULSE HEIGHT ANALYZER TO OBTAIN CODED DECIMAL PRESENTATION AND A DECIMAL PRINT-OUT. J. L. McKibben, J. D. Gallagher, and H. J. Lang (Los Alamos Scientific Lab., N. Mex.). IRE Convention Record 3, Part 10, 186-90(1955).

Modifications to the pulse height analyzer are described in detail, and complete circuit diagrams are given. (B.J.H.)

7865

A 100-CHANNEL PULSE HEIGHT ANALYZER USING MAGNETIC CORE STORAGE. Preston W. Byington and C. Wilkin Johnstone (Los Alamos Scientific Lab., N. Mex.). IRE Convention Record 3, Part 10, 204-10(1955).

The analyzer described uses a pulse height-to-time conversion to achieve linearity and constant channel width. Computer type magnetic memory cores are used as storage elements for each of the 100 channels. Twenty 10 × 10 matrix planes afford a maximum count storage of 10^5-1 in each channel and require 2½ tubes per channel for logics and driving circuits. Readout methods include a linear scope plot of all data, neon lamps, and a printed tape. Any pulse can be stored in 15 microseconds; however, individual pulse analysis requires an average of 200 microseconds. (auth)

7866

SERIAL MEMORY 100-CHANNEL PULSE HEIGHT ANALYZER. T. L. Emmer (Oak Ridge National Lab., Tenn.). IRE Convention Record 3, Part 10, 211-17(1955).

This paper describes a modified version of a pulse height analyzer, developed by G. W. Hutchinson and G. G. Scarrott of Cambridge University, which converts pulse heights into proportional time pulses with a voltage-to-time discriminator and stores the pulse-height information, as pulse sequences, in in a mercury delay line memory unit. (auth)

7867

SCINTILLATION SPECTROMETER FOR GAMMA RADIATION. M. Ageno, G. Cortellessa, and R. Querzoli. Rend. ist. super. sanita 18 Part 5, 344-66(1955). (In Italian)

A description is given of a single-crystal scintillation spectrometer for gamma rays especially adjusted for precision measurements with negligible long-time drift. The criteria and methods adopted for the determination of the counting threshold and of deviations from linearity are set out and also for checking the stability and the energy calibration. (auth)

7868

SCINTILLATION SPECTROMETER FOR COINCIDENCE EVENTS. M. Ageno, G. Cortellessa, and R. Querzoli. Rend. ist. super. sanita 18, Part 5, 367-75(1955). (In Italian)

A description is given of a scintillation spectrometer containing two crystals in coincidence. Each branch is equipped with a differential amplitude discriminator. The apparatus is designed to operate in the widest possible variety of experimental conditions and to give precision measurements with negligible long-time drift. (auth)

7869

BEHAVIOR OF GLASS WALL GEIGER-MÜLLER COUNTER EXTERNALLY TREATED WITH GRAPHITE UNDER INTENSE γ IRRADIATION. Daniel Blac (College de France, Paris). J. phys. radium 16, 681-7(1955) Aug.-Sept. (In French)

The structure of glass-wall Geiger-Müller counters externally treated with graphite is immediately adaptable to moderate radiations. All previous studies concerning them have had to use fairly low counting rates. The experiments described here concern their behavior at counting rates, approaching 50,000 counts/sec, from intense γ radiation. After a precision measurement of the sensitive volume of the counter, it is established that the variation of the Geiger threshold with counting rate, N_θ, is given by $\Delta V_g = BN_\theta \rho e/\pi b \sqrt{V_G^{\theta 2} - V_D}$, where ρ is the resistivity of the glass used, e is the thickness of the glass wall, b is the internal diameter of the cylinder, V_G^θ is the Geiger threshold for an associated circuit with a conveniently chosen threshold. The effective length of the cylinder does not apear in the equation. B is a parameter of the form $B = K \log_e b/a$, where a is the diameter of the anode. K is independent of the polyatomic constituent and of its pressure when it is beneath 1.4 cm Hg (for methylal, at least). The variation of K with pressure P_A of argon has been established experimentally. For $P_A \geq 12$ cm Hg, $K = 8.37 \times 10^{-12}/P_A$. These results are checked by identical experiments made on counters of the classic type with an internal cathode in the cylinder, and the bulk of which is placed in a conveniently chosen R-C system. These experiments allow a measurement of the resistivity of the glass used as a function of the temperature. The general fabrication principles and use of such counters for high counting rates are described. Concerning the fillings, three solutions are possible: pure polyatomic vapor, polyatomic vapor + argon under relatively high pressure, and polyatomic vapor + a gas chosen where K is less than that for argon. Hydrogen is suitable. Finally, a practical example of the counter is described, for which ΔV_g does not exceed the length of the plateau for weak radiation, as long as $N_\theta \leq 2.6 \times 10^6$ pulses/min. (tr-auth)

7870

THE DETECTION OF MESIC X-RAYS WITH PRESSURIZED PROPORTIONAL COUNTERS USING COSMIC RAY μ-MESONS STOPPED IN CARBON. D. West, R. Batchelor, and E. F. Bradley (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Phys. Soc. (London) A68, 801-9(1955) Sept. 1.

The advantages of proportional counters over scintillation counters in the study of mesic x rays from light elements are pointed out. A preliminary investigation is described in which mesic x rays from carbon are detected with proportional counters. Aluminium counters filled to a pressure of seven atmospheres of xenon were used. (auth)

7871

DETERMINATION OF PROTON SYNCHROTRON BEAM SIZE WITH A CRYSTAL SCINTILLATOR. R. Ledley and L. Riddiford (Univ. of Birmingham, England). Proc. Phys. Soc. (London) A68, 836-9(1955) Sept. 1.

A detailed description is given of a potassium iodide scintillator probe used to determine the proton synchrotron beam spatial distribution. Results are given graphically and discussed. (B.J.H.)

7872

ELECTRONIC MEASURING INSTRUMENTS. E. H. W. Banner. New York, MacMillan Co., 1955. 395p.

Information is presented on the design and theory of operation of various electronic measuring instruments, including radiation measuring instruments. (C.W.H.)

7873

GAMMA-RAY SCINTILLATION SPECTROMETER WITH LOGARITHMIC PULSE-HEIGHT RESPONSE. D. Maeder (Federal High School of Technology, Zurich, Switzerland). Rev. Sci. Instr. 26, 805-8(1955) Sept.

Practical use of scintillation spectrometers is unnecessarily complicated by the strong predominance of small pulses encountered especially in measuring complex spectra. The difficulties arising from this general trend

can be reduced by deforming the pulse spectra before recording them in a conventional linear pulse-height analyzer. A discussion of energy dispersion obtained with different types of deformation shows that a logarithmic transformation not only multiplies the counting rates of the original spectrum with a factor proportional to energy, but at the same time increases the energy band which can be resolved with a given number of counting channels. The reduction of counting rate extremes obtained by such a transformation permits attainment of higher total counting speeds with given multichannel equipment (assuming equal scaling factors in all channels); on the other hand, it facilitates accurate intensity measurements using photographic recording techniques. An electronic circuit is described, which accepts input pulses having a sharp rise (<1 μsec) and produces, 30 μsec later, a dc voltage in linear relationship with log [input pulse height]. The 100-v range of the output voltage is adjustable to cover pulse-height ratios from 1:2 up to 1:50. Gray-wedge spectrograms of the γ rays from Ra taken with the usual linear and with the new logarithmic circuit are presented. Theoretical calculations, as well as measurements with various calibration sources show that the photopeak counting efficiency of a NaI spectrometer becomes nearly constant over a wide energy range when the logarithmic energy transformation is introduced. (auth)

7874

PHOTOMETRIC DETERMINATION OF IONIZATION OF CLOUD-CHAMBER TRACKS. E. K. Björnerud (California Inst. of Tech., Pasadena). Rev. Sci. Instr. 26, 836-43(1955) Sept.

A photoelectric method for measuring the specific ionization of tracks on cloud-chamber photographs is described. An important feature of the method is the use of a comparison track of known ionization in the same part of the chamber. A microphotometer slit is made to scan the track perpendicular to its direction, and a tracing of the transmission of the track relative to the background transmission is obtained. A parameter relating the transmission of the track in question to the transmission of the comparison track is obtained directly from the tracings. Identified π-μ decays are used to establish a calibration curve, and the method is applied to various unknown tracks. The error of measurement is of the order of 10%. A theoretical treatment of the problem is carried out to show the effects of various physical parameters not easily ascertained experimentally. (auth)

7875

FAST COINCIDENCE SYSTEM WITH AMPLITUDE DISCRIMINATION AND ACCIDENTALS MONITORING. G. S. Stanford and G. F. Pieper (Yale Univ., New Haven, Conn.). Rev. Sci. Instr. 26, 847-9(1955) Sept.

A coincidence system with a short resolving time, variable up to 120 millimicroseconds, has been developed for use in $(\alpha,p\gamma)$ and $(d,p\gamma)$ correlation investigations. The system is a "slow-fast" one in that amplitude selection in both channels is made before the pulses reach the fast coincidence circuit, while accurate timing is achieved by parallel delaying and sharpening networks in each channel. The advantage of the slow-fast method is that it permits the inclusion in a simple way of an accurate monitor for accidental coincidences, thus allowing continuous accidentals monitoring while an experiment is in progress. A description of the whole system and details of new circuits and special components are given. (auth)

7876

AUTOMATIC INSTRUMENT FOR ELECTRON SCATTERING MEASUREMENTS. L. Marton, J. Arol Simpson, and T. F. McCraw (National Bureau of Standards, Washington, D. C.). Rev. Sci. Instr. 26, 855-8(1955) Sept.

An instrument capable of automatically recording the distribution in energy and angle of electrons scattered from solids is described. The energy range of the primary electrons is 10 to 50 kev. On a two-second cycle the instrument obtains and records an energy loss spectrum at a fixed angle, advances in angle, and repeats. The instrument will distinguish energy peaks less than 20 volts apart at 20 kev and angular details less than 10^{-3} radian apart. (auth)

7877

LIQUID SCINTILLATION TECHNIQUES FOR RADIOCARBON DATING. R. W. Pringle, W. Turchinetz, and B. L. Funt (Univ. of Manitoba, Winnipeg, Canada). Rev. Sci. Instr. 26, 859-65(1955) Sept.

A study has been made of the merits of liquid scintillation methods for radiocarbon dating. The synthesis of toluene from sample carbon, and the use of this liquid in a 20 cc cell, in combination with the best available photomultiplier tube, gave results which indicate that this method can be of significance for samples of age 45,000 years, for a 48 hour counting period. A background counting rate of 3.34 cpm was obtained with "old" toluene and adequate shielding and pulse height discrimination, but without photomultiplier cooling or the use of coincidence-anticoincidence arrangements. This method suffers, however, from a rather elaborate chemical synthesis. so that a simpler diluent technique was studied, involving the synthesis of methanol from sample carbon. This method is suitable for routine analysis, and gave results indicating a significance to 37,000 years, the decreased accuracy of the method being the result of the somewhat lower fluorescence efficiency of the scintillating mixture. There is evidence that a routine methyl borate diluent method will give an accuracy comparable to that of the toluene method. (auth)

7878

VACUUM LOCK FOR A MASS SPECTROMETER SOLIDS ENTRY SYSTEM. R. H. Roberts and J. V. Walsh (Dow Chemical Co., Denver, Colo.). Rev. Sci. Instr. 26, 890(1955) Sept.

A simple, low-cost vacuum lock is described which provides for the introduction of solid samples into the spectrometer chamber. Time required to introduce a sample and obtain a vacuum of 6×10^{-7} mm of Hg is 25 min. (K.S.)

7879

EFFECT OF CIRCUIT LOADING ON THE PRODUCTION OF OSCILLATIONS IN HALOGEN-QUENCHED G-M COUNTERS. W. G. Egan (Naval Material Lab., Brooklyn). Rev. Sci. Instr. 26, 891(1955) Sept.

Studies on circuit loading effects in halogen-quenched G-M tubes indicate that such loading effects the frequency and amplitude of (1) oscillations in the amplitude of the pulses occurring just after the dead time, and (2) continuous oscillations. A decrease in resistance of the anode resistor increases the incidence of pulses with type (1) oscillations, and decreases the pulse rise time and tube dead time. Spurious peaks and dead time is variously affected by an increase in capacitance across the tube, whereas the rise time increases steadily. A parallel circuit consisting of RC in series (in parallel with only the anode resistor) causes

an increase in the oscillatory pulses, with various effects on rise and dead time. These results indicate that the oscillations are determined in part by circuitry associated with the tube, and that type (2) pulses may occur without the addition of air to the gas fill of the tube. (K.S.)

7880

THIN SCINTILLATORS OF ZnS IN FUSED B_2O_3 FOR THERMAL NEUTRON DETECTION. S. B. Gunst, J. C. Connor, and R. T. Bayard (Westinghouse Atomic Power Div., Pittsburgh). Rev. Sci. Instr. 26, 894-5(1955) Sept.

The preparation of thin scintillators of ZnS in fused B_2O_3 is described. The advantage of thin scintillators in reducing γ sensitivity without affecting neutron sensitivity is discussed and illustrated. (B.J.H.)

MESONS

7881 AEC-tr-2257

TOTAL CROSS SECTION OF NEGATIVE π-MESONS AND DEUTERIUM INTERACTIONS IN THE 140 TO 400 MEV ENERGY REGION. A. E. Ignatenko, A. I. Mukhin (Moukhin), E. B. Ozerov, and B. M. Pontecorvo (Pontekorvo. Translated by M. B. Karalitz from Doklady Akad. Nauk S.S.S.R. 103, 209-12(1955). 6p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-7077.

7882 AEC-tr-2271

INELASTIC SCATTERING OF 300 MEV π^- MESONS BY COMPLEX NUCLEI. N. A. Mitin and E. L. Grigorev. Translated by M. Hamermesh from Doklady Akad. Nauk S.S.S.R. 103, 219-22(1955). 8p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-7078.

7883

THE IONIZATION LOSS OF RELATIVISTIC μ-MESONS IN NEON. D. A. Eyeions and B. G. Owen (Univ. of Manchester, England), B. T. Price (Atomic Energy Research Establishment, Harwell, Berks, England), and J. G. Wilson (Univ. of Leeds, England). Proc. Phys. Soc. (London) A68, 793-800 (1955) Sept. 1.

Proportional counters filled with neon have been used in conjunction with the Manchester magnetic spectrograph to investigate the relationship between the momentum and the most probable ionization loss for μ mesons at momenta greater than about 10^9 ev/c. The logarithmic increase of ionization loss with momentum is found to be in good agreement with that indicated by treatments which ignore interactions among the target molecules, and the onset of polarization effects is compared with that previously reported in oxygen. (auth)

7884

THE NON-MESONIC PHOTONUCLEAR REACTIONS INITIATED BY HIGH ENERGY μ-MESONS. Shin-ichi Kaneko, Tadayoshi Kubozoe, Moroe Okazaki, and Masaomi Takahata (Osaka City Univ., Japan). Progr. Theoret. Phys. (Japan) 13, 461-3(1955) Apr.

Four stars of the $1+1_p$ type, in which single slow protons starting from points within an emulsion were accompanied by two minimum ionizing tracks, were observed. A summary of the data from these stars is tabulated, and an attempt is made to explain the phenomenon as a non-mesonic photonuclear reaction initiated by high-energy μ mesons. (B.J.H.)

MOLECULAR PROPERTIES

7885

LUMINESCENT CENTERS IN ZnS:Cu:Cl PHOSPHORS. R. Bowers and N. T. Melamed (Westinghouse Research Labs., East Pittsburgh, Penna.). Phys. Rev. 99, 1781-7(1955) Sept. 15.

Measurements of the magnetic susceptibility and emission spectra have been made on zinc sulfide activated by copper and/or chlorine. The results of these measurements demonstrate that the luminescent centers are diamagnetic in the absence of optical excitation, and that of the five previously reported emissions, only three are distinct. These are a blue emission resulting from the addition of chloride, a green emission when copper and chloride are simultaneously present, and a red emission when copper alone is present. The results are discussed on an ionic model and on a semiconductor model. We conclude that the blue emission is due to zinc vacancies, the green emission to substitutional copper, and the red emission to interstitial copper. (auth)

7886

MULTIPLE ELECTRON EXCITATION IN AUGER PROCESSES. Max Wolfsberg and Morris L. Perlman (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 99, 1833-5(1955) Sept. 15.

Consideration of the Auger effect as a polyelectron phenomenon leads to the expectation of an accumulation of a greater charge on an atom, as the result of an Auger cascade, than that obtainable by the conventional two-electron theory. On this basis, calculations are made of the probability for the accumulation of large charges by chlorine atoms originally possessing a K vacancy. The theoretical results correlate well with the recent experimental measurements of the charge distribution of the chlorine atoms produced by the electron-capture decay of A^{37}. (auth)

7887

PHOTOLUMINESCENT MODULATION IN NONUNIFORMLY EXCITED ZnS PHOSPHORS. R. E. Halsted (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. 99, 1897(1955) Sept. 15.

Experiments are described in which the photoluminescence of some ZnS phosphors was modulated by an alternating electric field applied parallel to the incident radiation. Modulation was observed with 2537 A excitation of ZnS:Ag,Cl and ZnS:Cu,Al and with 3650 A excitation of ZnCdS:Ag,Cl and ZnSSe:Cu,Cl phosphor powder samples. The experiments provide a simple demonstration of n-type photoconductivity and clarify the role of conduction electrons in the luminescent process. (M.P.G.)

NEUTRONS

7888

MULTIPLICATION OF NEUTRONS IN URANIUM–GRAPHITE SYSTEMS. L. V. Groshev, E. L. Feinberg, and I. M. Frank. p.3-20 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p.

A general introduction is presented to a group of three subsequent papers on experimental and theoretical investigations. The purpose of the investigations was to study the

physical aspect of neutron multiplication in a heterogeneous uranium-graphite system. The experiments were conducted on a prism (exponential method). (auth)

7889

MEASUREMENT OF RESONANCE ABSORPTION OF NEUTRONS IN A URANIUM–GRAPHITE LATTICE. p.53-66 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

Resonance absorption by cylindrical uranium lumps, depending on the diameter and temperature of the rod, has been investigated experimentally. Several methods for the absolute determination of the probability of resonance absorption in a U-graphite lattice have been examined. It has been found that the total resonance absorption consists of blockaded and nonblockaded parts. The dependence of the resonance absorption probability $(1-\varphi)$ on the diameter of the lump D and the lattice spacing α is given by the following semiempirical formula $-\ln\varphi = 5.87\ D^{\frac{1}{2}} + 3.02\ D^2/\alpha^2 - (\pi D^2/4)$, provided $0.01 \le D \le 5$ cm. The Doppler broadening of the resonance levels leads to an increase in resonance absorption $-\ln\varphi = 5.87 \cdot 0.775\ (1 + 17.5 \cdot 10^{-3}\sqrt{T})\ D^{\frac{1}{2}} + 3.02D^2/\alpha^2 - (\pi D^2/4)$ where T is the temperature of the lump in absolute degrees. The results of the experiments confirmed the predictions of the resonance absorption theory. (auth)

7890

RESONANCE ABSORPTION OF NEUTRONS IN HETEROGENEOUS SYSTEMS. N. A. Burgov. p.67-86 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Acadmey of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

An account of the results of experiments on the resonance absorption of neutrons in uranium-heavy water systems is given. The experimental value of φ, the resonance escape probability, was determined for a uranium-heavy water lattice with uranium rods having a diameter $d_c = 14$ mm and a lattice spacing equal to $a = 58$ mm. Uranium and bismuth rods coated with cadmium were put by turns in an aluminium vessel filled with heavy water. The neutron density was compared by means of the ionization chamber. A 500 mc Ba–Be source of neutrons was used. The resulting value of φ for the investigated lattice obtained equalled $\varphi = 0.879 \pm 0.008$. Calculation from the results of the critical experiments in the heavy-water research reactor gave the value of $\varphi = 0.875 \pm 0.010$ for a lattice with uranium rods with the diameter $d_c = 22$ mm and lattice spacing $a = 90$ mm. (auth)

7891

DEPENDENCE OF EFFECTIVE NUMBER OF SECONDARY NEUTRONS ON ENERGY OF CAPTURED NEUTRONS. PART I. S. Ya. Nikitin, S. I. Sukhoruchkin, K. G. Ignat'ev, and N. D. Galanina; PART II. S. Ya. Nikitin, P. A. Krupchitskii, and V. F. Belkin. p.87-107 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

The results of measurements of the capture and fission of slow neutrons were used to determine the energy dependence of the effective number of secondary neutrons $(\nu_{eff} - \nu\ (\sigma_f/\sigma_c))$. The 128-channel neutron time-of-flight selector was used in conjunction with a cyclotron. The capture cross-section σ_c, the relative trend of the fission cross-section σ_f, and the effective number of secondary neutrons ν_{eff} were measured within the energy interval from 0.01 to 10–40 ev. The capture and fission cross-section show a number of resonances. For several levels, the values of Γ_f (fission-width) and Γ_γ (radiation-width) were determined. Considerable variation of Γ_f for different levels was observed. The ratio of $\bar{\nu}_{eff}$ to the ν_{eff} measured for the thermal region varies for different groups of resonances within the following limits: for U^{233}, from 0.85 to 1.08; for U^{235}, from 0.6 to 0.9; and for Pu^{239}, from 0.85 to 1.15. The ratio of the ν_{eff} for neutrons of intermediate energies to that for the thermal energies for U^{233} was measured. The intermediate neutron spectrum contained neutrons within the energy interval extending from 0.5 ev to 1000 ev. This spectrum was obtained by means of a neutron-energy transformer, consisting of a heavy-water tank and a boron-slab lattice. A uranium block located at the bottom of the tank served as a source of neutrons. It was irradiated by thermal neutrons emerging from the vertical experimental channel of the heavy-water research reactor. The neutron detectors, a fission chamber lined with U^{233} and a proportional counter lined with boron, were placed within the tank. The ratio of $\nu_{eff}/\nu_{eff\ th}$ obtained equalled 1.02 ± 0.03. The excess of the fission cross section of U^{233} compared with the 1/v law was determined. It equalled 3.32 ± 0.02. (auth)

7892

AVERAGE NEUTRON VELOCITIES IN VARIOUS MEDIA. K. D. Tolstov, F. L. Shapiro, and I. V. Shtranikh. p.108-31 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

The process of slowing down of neutrons in the vicinity of the thermal equilibrium region is influenced by many factors. For instance, the average energy and spectrum of the neutrons depend on the mean energy transferred due to inelastic collisions, on the capture cross section, the structure and the volume of the moderator, the temperature of the medium, etc. The present work is devoted to a study of the influence of these factors on the average velocity and on the spectrum of the thermal neutrons. Experiments were performed in graphite, paraffin and water prisms with and without increments possessing I/V absorption. Heterogeneous systems containing graphite and water as moderators were also investigated. It was shown that in graphite, paraffin and water, the neutrons attain thermal equilibrium and their velocity spectrum is Maxwellian. The average velocities of neutrons at 20°C and at 300°C in heterogeneous uranium-graphite systems of different uranium concentrations were measured. It was proved that for a given concentration the average neutron velocity in a homogeneous system is considerably higher than that in a heterogeneous one. An explanation of this fact is given. It was found that within the uranium-graphite systems the neutron spectrum is not Maxwellian. If the average velocity values found experimentally are used in the calculations, the agreement between the calculated and measured figures for the absorption of neutrons in graphite and for the neutron migration area is improved. It was proved, both by calculations and by measurements, that the spectrum of neutrons emitted by the moderator surface is determined not only by their spectrum

in the moderator, but by the energy dependence of the mean free transport path λ_{tr} as well. (auth)

NUCLEAR PHYSICS

7893 COO-172

Purdue Research Foundation, Lafayette, Ind.

RESEARCH IN NUCLEAR PHYSICS. PROGRESS REPORT NO. 5. June 15, 1955. 113p. Contract AT(11-1)-122.

The cyclotron is being adapted to the acceleration of He^3. Modifications in the beam focusing apparatus and scattering chambers are described. The energy distribution of protons from (α,p) reactions has been studied using Rh and Cu targets. Data are presented for Rh^{103}, Cu^{63}, and Cu^{65}. Calculated and measured (α,p) cross sections are compared for the 3 isotopes. The elastic scattering of 19 Mev α particles from Al and Cu is being studied, and data are presented. Calculations of the ratio of proton to neutron yield from excited states of self-conjugate nuclei were made. The reaction $Ni^{58}(\alpha,\gamma)Zn^{62}$ was studied to determine whether capture of the protons from the orbit occurs to a significant extent. The angular correlation of successive nuclear radiations is being studied. Results are presented from investigations of the directional correlation of Cd^{111} and Ta^{181} γ rays and the time dependent quadrupole interaction in liquid sources of In^{111}. The magnetic moment of the 247 kev excited state of Cd^{111} was determined utilizing directional correlation measurements. The directional correlation of the 722-kev to 556-kev γ cascade of Cd^{114} was measured with the use of differential pulse height selection. A fast coincidence scintillation spectrometer for delayed directional correlation measurements is described. The decay of Sc^{44} was studied to investigate an anomalously large probability of electron capture and a large number of low-energy electrons accompanying the positron decay. The conversion coefficients of Pt^{196} γ rays have been determined with a lens spectrometer. Results are reported from a study of the decay scheme of Au^{194}. The γ-ray spectra of P^{34}, Cl^{34}, and P^{30} have been investigated. Some preliminary considerations of the effective mass of nucleons in nuclei have been made. (For preceding period see COO-171.) (M.P.G.)

7894

CERTAIN PROBLEMS ON NUCLEAR THEORY. A. Akhiezer and I. Pomeranchuk. Moscow-Leningrad, Gostekhizdat, 1948. 320p. (In Russian) (Book on display at Geneva Conference)

Results on scientific achievements in the nuclear theory—a summary of publications on this subject. Processes in which neutrons participate; interaction between neutrons and protons, statistic properties of heavy nuclei, resonance phenomena, division of heavy nuclei, interaction of slow neutrons with substance; reaction of fission of fast neutrons in coulomb nuclear fields. (publisher's note)

7895

THE ATOMIC NUCLEUS. M. I. Korsunskiĭ. Moscow-Leningrad, Gostekhizdat, 1952. 374p. (In Russian) (Book on display at Geneva Conference)

A popular exposition of nuclear physics and its development. The structure of the atomic nucleus, forces acting between nuclear particles; experiments in the artificial fission of atomic nuclei. Nuclear fission and the possible applications of atomic energy. (publisher's note)

7896

ISOMERY OF ATOM NUCLEI. M. I. Korsunskiĭ. Moscow, Gostekhizdat, 1954. 327p. (In Russian) (Book on display at Geneva Conference)

A monography on theoretic investigations and experimental data on isomeric nuclei, their origin and behavior. Investigations of the structure of atomic nuclei. A summary table of isomeric nuclei indicating their properties and numerous diagrams of isomeric transformations are given at the end of the book. (publisher's note)

7897

ATOMIC ENERGY. V. A. Leshkovtsev. Moscow, Gostekhizdat, 1954. 72p. (In Russian) (Book on display at Geneva Conference)

A popular booklet on some of the problems of nuclear physics: the structure of the atom and the atomic nucleus, nuclear transformations, and methods of generating nuclear energy. Nuclear fission and the possible applications of atomic energy. (publisher's note)

7898

RADIOACTIVE ELEMENTS AND THEIR APPLICATION. A. N. Nesmeyanov. Moscow, Ministerstvo Oborony S.S.S.R., 1955. 123p. (In Russian) (Book on display at Geneva Conference)

The principles of the structure of matter and the properties of the radioactive elements; discovery and investigation of artificial radioactivity. Labelled atom method and its application in various fields of science and engineering, the uses of atomic energy for peaceful and war purposes. (publisher's note)

7899

INTRODUCTORY REMARKS AT THE SESSION OF THE ACADEMY OF SCIENCES OF THE U.S.S.R. ON THE PEACEFUL USE OF ATOMIC ENERGY. A. N. Nesmeyanov. p.9-14 in Plenary Meeting. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 106p. (In Russian)

7900

VARIATION WITH VIBRATION OF THE FLUORINE SPIN-ROTATION INTERACTION IN Li^6F. S. O. Kastner, A. M. Russell, and J. W. Trischka (Syracuse Univ., N. Y.). J. Chem. Phys. 23, 1730(1955) Sept.

Calculations of the spin-rotation coefficient, c, from the energy term $c\,\mathbf{I}\cdot\mathbf{J}$, have been made for the three lowest vibrational states of Li^6F. (C.W.H.)

7901

NUCLEAR PHYSICS. Alex E. S. Green. New York-Toronto-London, McGraw-Hill Book Co., Inc., 1955. 535p.

In general, the chapters of this book fall into the major topical groups: (1) background, (2) instruments and methods, (3) experimental results and their interpretation, (4) systematics and semiempirical theory, and (5) theory. For much of the book, the reader needs only a sound background of intermediate courses in physics and mathematics, including a course in atomic physics. However, some familiarity with quantum mechanics is desirable for the latter chapters of the book. (L.M.T.)

NUCLEAR PROPERTIES

7902 CEA-338

France. Commissariat a l'Énergie Atomique, Paris.

EVOLUTION DE LA DISTRIBUTION ANGULAIRE DES

PROTONS $^{16}O(d,p)^{17}O$ AU VOISINAGE D'UNE RESONANCE DE CAPTURE DU DEUTERON. [Proton Angular Distribution of $O^{16}(d,p)O^{17}$ Near a Deuteron Capture Resonance]. A. Berthelot, R. Cohen, E. Cotton, H. Farraggi, T. Grjebine, A. Leveque, V. Naggiar, M. Roclawski-Conjeaud, D. Szteinsznaider. July 26, 1954. 30p.

The study of angular distributions of the protons from the reaction $O^{16}(d,p)O^{17*}$ (level at 875 kev) was made, using a photographic method, at 7 different deuteron energies from 1.66 to 2.20 Mev. The analysis of results shows that the angular distribution for forward angles is, for each chosen energy, in good agreement with the stripping theory (l = 0), even at the maximum of the capture resonance of the deuteron, about 2.1 Mev. Moreover, the differential cross section at 7° reaches a maximum for this resonance energy. (tr-auth)

7903 UCRL-3114

California. Univ., Berkeley. Radiation Lab.
ELASTIC SCATTERING OF 48-Mev ALPHA PARTICLES BY HEAVY NUCLEI (thesis). Robert E. Ellis. Aug. 22, 1955. 44p. Contract W-7405-eng-48.

The angular distributions of α particles scattered elastically from Ag, Au, and Pb targets have been measured. Deviations by 3 to 4 orders of magnitude from pure Coulomb scattering have been observed beyond the forward angles. In addition, some regular structure appears in these distributions, but the main features can be described by an exponential fall-off between 25° and 90°. By fitting the data with a simple modification of Blair's scattering theory, it has been possible to determine interaction radii. Nuclear radii have been derived which are in agreement with those found from medium-energy nucleon scattering. (auth)

7904

ATOMIC NUCLEI AND NUCLEAR TRANSFORMATIONS. VOL. I. NUCLEAR PHYSICS TABLES. I. P. Selinov. Moscow-Leningrad, Gostekhizdat, 1951. 346p. (In Russian) (Book on display at Geneva Conference)

Characteristics of atomic nuclei and diagrams of nuclear reactions. Vol. I. Reference data and bibliography. Table I —data on stable and radioactive nuclei, their properties and nuclear transformations. Table II—a systematization of various nuclear reactions of formation of radioactive nuclei from stable elements. The three concluding tables are coloured inserts and include a classification of atomic nuclei, a proton-neutron diagram of the nuclei, and Mendeleyev's Period Table. Bibliography of experimental studies from 1896 to 1949. (publisher's note)

7905

ALPHA-SPECTRA OF HEAVY ELEMENTS. L. L. Gol'din, E. F. Tret'yakov, and G. I. Novikova. p.226-50 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

The α-particle spectra were studied, utilizing a 50 cm radius precision double-focusing magnetic α-spectrometer with 2×10^{-4} of 4 π transmission and 7.5 kev resolution, determined as half-maximum width. The automatic stabilization of coil current secured 0.01% long-time stability. The spectrometer construction was preceded by an extensive study of the theory of particle focusing in magnetic fields with cylindrical symmetry. The α spectra of U^{233}, U^{234}, Pu^{238}, Pu^{239}, Pu^{240}, Am^{241} and Pa^{231} were studied. The α spectrum of U^{232} contains 4 groups characterized by energies 4815.7, 4773.2, 4717.4, and 4489.0 kev with abundances 83.5%, 14.9%, 1.6%, and 0.03% correspondingly. The α spectrum of U^{234} contains 2 groups, energies and abundances of which are 4768.3 kev (72%) and 4716.8 kev (28%). The α spectrum of Pu^{238} contains 2 groups: 5490.9 kev (69%) and 5449.9 kev (31%). The α spectrum of Pu^{239} contains 3 groups: 5147.4 kev (72.5%), 5134.4 kev (16.8%) and 5096.3 kev (10.7%). The α spectrum of Pu^{240} contains 2 groups: 5158.9 kev (72.5%), 5114.7 kev (24.5%). The α spectrum of Am^{241} contains 6 groups: 5540.8 kev (0.39%), 5508.2 kev (0.24%), 5482.0 kev (85%), 5439.1 kev (12.84%), 5386.0 kev (1.66%) and 5321.0 kev (0.015%). A 7th group 5241 kev (0.002%) was discovered. This line, not yet confirmed by γ-rays, may be due to admixtures. The Pa^{231} α spectrum contains 9 groups: 5049.0 kev (12%), 5020.5 (23%), 5006 (26%), 4974 (1.5%), 4942 (24%), 4848 (1.5%), 4727 (10%), 4704 (0.8%) and 4671 kev (1.3%). Three independent rotation groups of α particles are assumed in the Pa^{231} α radiation. The first of them is bound with the 0, 2, 4 α groups, the second, with the 1 and 3 groups, and the third with 6 and 8 groups. The data obtained are compared with γ spectra and electron conversion spectra. New level schemes for U^{233}, Am^{241} and Pa^{231} are presented. (auth)

7906

ENERGY LEVELS OF U^{237} NUCLEUS AND DECAY OF Am^{242m}. S. A. Baranov and K. N. Shlyagin. p.251-69 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

The radiations of U^{237}, Am^{241} and Am^{242m} have been studied using the magnetic double-focusing β-ray spectrometer and other instruments. Investigation of the first two isotopes has made it possible to determine the energy levels of the Np^{237} nucleus. A study of the third isotope makes it possible to draw conclusions regarding its decay scheme. The U^{237} and Am^{242m} isotopes were obtained from the reactions $U^{236}(n,\gamma)U^{237}$ and $Am^{241}(n,\gamma)Am^{242m}$. The Am^{241} isotope was chemically separated from plutonium enriched with Pu^{241}. The U^{237} electron spectrum has been studied in the energy interval of 1 to 300 kev. The beta decay of U^{237} is accompanied by radiation of many conversion and Auger electrons. An analysis of the experimental data has made it possible to establish the existence of two β components with end-point energies of $E_{\beta 1} = 84 \pm 5$ kev and $E_{\beta 2} = 249 \pm 5$ kev, respectively, occurring in the decay, and the following transitions of the Np^{237} nuclei: E = 26, 33, 43, 60, 69?, 101, 124?, 165, 193?, 208, 268, 330, 370, and 433 kev. The following transitions of Np^{237} have been determined also in studying the electron spectrum of Am^{241}: $E\gamma$ = 26, 33, 43, 55, 60 and 99 kev. As a result of the study of the above electron spectra of U^{237} and Am^{241}, the following energy levels of the Np^{237} nucleus have been determined: 0, 33, 22, 59, 62, 103, 55, 158, 55, 227, 268 and 433 kev. The first six levels have the following spin values, respectively: $\frac{5}{2}\pm$, $\frac{7}{2}\pm$, $\frac{5}{2}\pm$, $\frac{7}{2}\pm$, $\frac{9}{2}\pm$, and $\frac{11}{2}\pm$. The levels 59.62, 103.55, 158.55 and 227 kev are rotation levels of the Np^{237} nucleus. The electron spectrum of Am^{242m} has been investigated in the energy interval of 1 to 700 kev. Approximately ten conversion lines and three Auger-electron groups have been detected. The observed intensity of the conversion peaks and the Auger-electron

groups decreased with the half life which is about 16 hours. An analysis of the experimental data has made it possible to establish two beta components occurring in the decay of $Am^{242m} \rightarrow Am^{242}$ with end-point energies equal to E_{01} = 625 ± 5 kev (49%) and E_{02} = 667 ± 5 kev (33%), respectively, and γ-ray Cm^{242} Eγ = 42 kev. Measurement with a proportiona counter has shown that one mode of decay of the Am^{242} is electron capture. This mode of decay (Am^{242m} electron capture Pu^{242}; γ ray Pu^{242} E_γ = 44 kev) is equal to about 18%. On the basis of the obtained data, the beta-transition energy of Am^{242} to the excited level of Cm^{242} has been calculated. This energy has been found to be $E_0 \approx 580$ kev. A decay scheme for Am^{242m} has been plotted with Am^{242m} having a 0^- spin. The spin of the ground state of Am^{242} is equal to 4 or 5. The question of parity remains open. (auth)

7907

NEUTRON CAPTURE OF γ-RAY SPECTRA OF SOME HEAVY NUCLEI. B. P. Ad'yasevich, L. V. Groshev, and A. M. Demidov. p.207-93 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

The results of measurements of γ-ray spectra emitted by Cd, Sm, Hg and Pb under neutron irradiation in the thermal column of the RTF reactor are given. A magnetic spectrometer for energy selection of Compton electrons produced in a thin radiator was used for measuring the γ-ray spectra. The spectrometer made it possible to investigate the γ rays in the energy range from 0.3 to 12 Mev. A large number of peaks corresponding to respective monochromatic γ rays were detected in the γ-ray spectra of Cd, Sm and Hg. Both the corresponding γ-ray energies and the intensities expressed in photons per neutron capture were determined. Comparison of the experimental data with those obtained by other authors showed satisfactory agreement in the overlapping energy range. Possible γ-decay schemes for the above nuclei are proposed. Study of the γ-ray spectrum emitted by lead after thermal neutron capture showed the existence of one ground state transition in both cases of the Pb^{207} and Pb^{208} isotopes. The result agrees with data previously published by other authors. The obtained γ decay schemes were used to determine the neutron binding energy in Sm^{150} and Hg^{200}: 8.00 ± 0.03 Mev and 8.03 ± 0.03 Mev, respectively. The angular moments of the compound nuclei are shown to be 0^{-2} and 4^{-2} for Hg^{200} and Sm^{150}, respectively. Hence, the Sm^{149} ground state spin is equal to $^7/_2^-$. Multipolar orders and partial widths have been determined for a number of Cd, Sm and Hg transitions. The partial widths are compared with those calculated by the Weisskopf formula. (auth)

7908

ACCELERATOR STUDIES OF HIGH ENERGY PROCESSES. M. G. Meshcheryakov. p.39-59 in Plenary Meeting. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 106p. (In Russian)

This paper deals with the results of recent research in high energy particle physics. In the experiments made on the synchrocyclotron of the Institute of Nuclear Problems of the USSR Academy of Sciences, main attention was paid to the investigation of the following processes in the energy region 380 – 660 Mev: elastic (p,p), (n,n) and (n,p) scattering; production of charged and neutral pions in nucleon–nucleon collisions; and, pion-nucleon scattering. In the mentioned energy range, a strong deviation from isotropy in the (p,p) scattering was found. The contribution of nonelastic processes to the total (p,p) interaction cross-section at 660 Mev is about 50%. In the experiments with pions, additive and positive pion total cross-sections in hydrogen was obtained. All the new experimental facts on the nucleon–nucleon and pion–proton scattering do not disagree with the assumption of charge independence of nuclear forces. Disintegration of atomic nuclei and pion production by photons of energy up to 250 Mev were investigated in a series of experiments performed on the synchroton of the Physics Institute of the USSR Academy of Sciences. By studying the photoproduction of neutral mesons on deuterons, it was established that the meson charges of the neutron and of the proton have equal value but opposite signs. In the conclusion, the results of recent experiments on accelerator production of photomesons, heavy mesons and hyperons are briefly discussed. (auth)

7909

ANGULAR CORRELATION OF THE ELECTRON PAIRS OF THE MONOPOLAR TRANSITION OF O^{16} (6.05 MEV): ENERGY SPECTRUM OF THESE PAIRS. Serge Gorodetzky, Raymond Armbruster, Pierre Chevallier, Andrć Gallmann, and Robert Manquenouille. Compt. rend. 241, 698-700(1955) Sept. 12. (In French)

The angular correlation of electron pairs from the 6.05-Mev excited level of O^{16} was studied, and an experimental value of $W(\theta) = 1 + (0.955 \pm 0.007) \cos \theta$ was found. A coincidence spectrometer was used to measure the energy partition of the particles, and the data are given in graphical form. (B.J.H.)

7910

PRELIMINARY MEASUREMENT OF THE MAGNETIC MOMENT OF THE EXCITED STATE OF F^{19} AT 197 KEV. Pierre Lehmann, Antoine Leveque, and Marcel Fiehrer. Compt. rend. 241, 700-2(1955) Sept. 12. (In French)

The magnetic moment of the 167-kev excited state of F^{19} was measured by a study of the perturbation of the γ-ray angular distribution under the influence of a magnetic field. A lower limit to the magnetic moment was set at $\mu = +4.0 \pm 0.9$ nuclear magnetons. (B.J.H.)

7911

THE NUCLEAR ORIENTATION OF COBALT 57. G. R. Bishop, M. A. Grace, C. E. Johnson, A. C. Knipper, H. R. Lemmer, J. Perez y Jorba, and R. G. Scurlock (Clarendon Lab., Oxford, England). Phil. Mag. (7) 46, 951-6(1955) Sept.

The isotope ^{57}Co has been studied by the method of nuclear alignment in cobalt rubidium sulfate. By determining the angular distribution of the γ radiation following its decay and its plane of polarization it is shown that the 123-kev transition is predominantly M1 with a small admixture of E2 ($\delta = +0.19 \pm 0.02$). (auth)

7912

INELASTIC SCATTERING OF 2.5 MEV NEUTRONS BY ^{54}Fe AND ^{56}Fe. L. E. Beghian, D. Hicks, and B. Milman (Clarendon Lab., Oxford, England). Phil. Mag. (7) 46, 963-7(1953) Sept.

A NaI(Tl) crystal was used to study the gamma radiations emitted by natural iron, Fe^{54}, and Fe^{56} scatterers. Gamma rays of the following energies were observed: from natural iron 0.85 ± 0.03, 1.22 ± 0.05, 1.42 ± 0.05 Mev. The 1.4-Mev gamma ray was not present with the Fe^{56} scatterer. A 1.37 ±

0.05 Mev line was observed with the Fe^{54} scatterer. In addition the neutrons scattered from natural iron were studied with a stilbene crystal, and groups corresponding to levels at 0.85 ± 0.03 Mev and 1.45 ± 0.05 Mev were found. On the basis of the above the following levels can be identified: in Fe^{56} 0.85 ± 0.03 Mev, 2.07 ± 0.05 Mev, in Fe^{54} 1.40 ± 0.05 Mev. (auth)

7913

SPIN-ORBIT COUPLING AND THE DENSITY DISTRIBUTION IN HEAVY NUCLEI. R. J. Blin-Stoyle (Clarendon Lab., Oxford, England). Phil. Mag. (7) 46, 973-81(1955) Sept.

The spin–orbit coupling experienced by a nucleon in a nucleus is interpreted in terms of a neutral two-body spin–orbit potential. An expression of the Thomas form is obtained for the effective spin–orbit potential. It is shown that the spin–orbit splitting in heavy nuclei can be explained satisfactorily if the nuclear density distribution has a finite transition region at the surface and if the neutron distribution has a larger radius than the proton distribution. (auth)

7914

THE LOW LYING LEVELS OF ^{25}Al. L. L. Green, J. J. Singh, and J. C. Willmott (Univ. of Liverpool, England). Phil. Mag. (7) 46, 982-8(1955) Sept.

The γ spectrum at the 825-kev resonance in Mg^{24} has been investigated and the angular distributions of the three initial γ rays measured. The spins and parities of the ground state and first excited states are confirmed as $\frac{5}{2}^+$ and $\frac{1}{2}^+$ respectively and the second excited state is shown to be $\frac{3}{2}^+$. Evidence is presented which lends a measure of support to the view that a level exists in Al^{25} at 1.92 Mev. (auth)

7915

UPPER LIMITS FOR THE LIFETIMES OF THE EXCITED STATES OF TITANIUM 46. R. E. Azuma (Univ. of Glasgow, Scotland). Phil. Mag. (7) 46, 1031-3(1955) Sept.

The excited state lifetimes of Ti^{46} were both found to be less than 5×10^{-11} sec, after measurements with a fast coincidence apparatus with a resolving time of 2.5×10^{-9} sec. (L.M.T.)

7916

THE LIFETIME OF THE FIRST EXCITED STATE OF THALLIUM 203. R. E. Azuma and G. M. Lewis (Univ. of Glasgow, Scotland). Phil. Mag. (7) 46, 1034-6(1955) Sept.

The lifetime of the first excited state of Tl^{203} was found to be $(3 \pm 1) \times 10^{-10}$ sec, from measurements with a coincidence unit of resolving time of $\sim 2 \times 10^{-9}$ sec. (auth)

7917

DIPOLAR AND QUADRUPOLAR TRANSITIONS OF CERTAIN ELEMENTS (Z = 83, 82, 78, 74) CALCULATION OF RADIATIVE WIDTHS AND RELATIVE INTENSITY OF CORRESPONDING X-RAYS. Williams Laskar (Institut du Radium, Paris). J. phys. radium 16, 644-9(1955) Aug.-Sept. (In French)

Relativistic calculations of 22 transition probabilities for Bi, Pb, Pt, and W are given. A table of these results and of those obtained in 1936 by Massey and Burhop for U, Au, and Sb are summarized in the corresponding curves. Discussion and interpretation of the results are given. (tr-auth)

7918

DISINTEGRATION OF Cu^{59} AND THE STABILITY OF $_ZX^{2Z+1}$ NUCLEI. T. Yuasa, M. E. Nahmias, and M. Vivargent (College de France, Paris). J. phys. radium 16, 654-8(1955) Aug.-Sept. (In French)

An experimental study of the disintegration of Cu^{59} shows $E_{\beta+\,max} = 1.85 \pm 0.05$ Mev and a 1.75-Mev γ ray to be $\leq 2\%$ of the β^+. The mass of Cu^{59} was calculated as 58.95602 ± 0.00030 m. u., and the reaction energy of $Ni^{58}(d,n)Cu^{59}$ was found to be Q = 3.26 ± 0.45 Mev. General considerations of the stability of $_ZX^{2Z+1}$ nuclides, in connection with the shell model of the nucleus, are given. (tr-auth)

NUCLEAR REACTORS

7919 AECD-3658

Massachusetts Inst. of Tech., Cambridge. Nuclear Engineering Project.

DYNAMICS AND CONTROL OF THERMAL REACTORS. Sept. 15, 1953. Decl. with deletions May 25, 1954. 45p. Contract AT(30-1)-1359.

Study of the various PD reactors from the control viewpoint has shown that control is entirely feasible for each. Conventional nuclear instrumentation is adequate for monitoring the performance of all the reactors, and for control of those that are not self-regulating because of inadequate negative temperature and power coefficients of reactivity. The dynamic behavior of all the reactors is compatible with that of the steam-generating and turbogenerator parts of the plant, so that complete control of the plant is entirely practicable, not only during normal operation but also during abnormal conditions. Human operators in the plant have relatively simple operations to perform in maintaining optimum conditions of operation which provide the highest over-all efficiency. Thus operating personnel need not have any scientific background, and extensive training periods are not required. Safety of the plant and personnel is assured by automatic safety devices and does not depend on human response to abnormal conditions. Maintenance of the control and instrumentation presents no unusual difficulty, with the possible exception of primary detectors permanently located within the reactor, such as thermocouples for measurement of internal temperatures. Such detectors, which involve no moving or fragile parts, should be of such rugged heavy-duty construction that maintenance during the expected life of the reactor will not be required. Costs of the control and instrumentation for each of the PD reactors is a minor fraction of the over-all costs of the whole power plant. In no case does the estimated cost exceed 1.6% of the total estimated cost of the whole plant. For the LMFR plant the control-instrumentation cost is only 0.38% largely because control rods are considered to be unnecessary for that reactor. The pressurized water reactor is the only one whose control-instrumentation cost (1.6%) exceeds 1%, principally because of the control rod drive mechanisms. Further study and development of control instrumentation for power-plant reactors may lead to simplification and cost reduction of the control system. For example, investigation of alternate control schemes for the pressurized-water cooled reactor may make possible elimination of the $500,000 cost of the pressurized control rods and their drive mechanisms. If the rods cannot be eliminated, the mechanism may perhaps be simplified. Other investigations recommended are as follows: development of simple, reliable, inexpensive methods for shim control and measurement, particularly for the LMFR; development of methods and means for control of a boiling reactor; and study of the possibility of making some of the PD reactors

so self-regulating that elimination of the need for all automatic safety shutdown is practicable. Thus the embarrassment associated with unexpected shutdowns is eliminated, as well as considerable equipment. (auth)

7920 AECD-3659

Massachusetts Inst. of Tech., Cambridge. Nuclear Engineering Project.

REACTOR STEAM POWER PLANTS—ECONOMICS. Sept. 15, 1953. Decl. May 25, 1954. 24p. Contract AT(30-1)-1359.

Costs and heat rates of economically "balanced" steam power plants have been determined as functions of initial steam conditions and incremental heat cost. Immediate determination of optimum power plant investment and of thermodynamic performance is possible for a wide range of initial steam conditions if incremental Btu costs are known. Several classes of cycles are covered, for each of which (1) the turbine exhaust annulus area and (2) the condenser surface and circulating water system capacity have been varied in addition to the initial steam conditions. Circulating water temperature is assumed constant at 65°F. All cycles considered have gross capabilities of 150 MW. The significance of the results may be judged by the fact that for the typical initial state of 600 psia saturated, investment costs vary from $88.60 to $98.70 per kilowatt of installed capacity for a corresponding change in heat rate from 10,610 to 10,128 Btu/kwh. The incremental costs of heat at which these two investments are justified are $0.40 and $0.60 per million Btu, respectively. (auth)

7921 CRCE-607

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE STRIPPING OF OXYGEN FROM SOLUTION BY A PARTIAL FLASH VAPORIZATION. D. H. Charlesworth. June 1955. 23p.

The stripping of gases from solution is of interest as a means of continuously removing the fission product poison, Xe^{135}, from the fuel of a homogeneous reactor. An experimental study of the continuous stripping of oxygen from solution by a partial flash vaporization of the liquid followed by subsequent contacting of the vapor and liquid phases showed that efficient stripping could be accomplished by this method. However, equilibrium is not attained in the vaporization process itself. Essentially, partial flash vaporization provides a means of generating the carrier gas within the system without introducing a foreign gas. A mathematical analysis indicates that the low concentration levels which would be encountered in the removal of Xe from reactor fuels should not directly affect the efficiency of the stripping process. (auth)

7922 CRR-590

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

CATALOGUE OF NUCLEAR REACTORS. Aug. 1955. 58p. (AECL-220)

Data are summarized from the unclassified literature on 46 reactors known to have reached criticality by July, 1955. The reactors are classified under various categories and construction details are outlined. References covering the more complete sources of information are included for each reactor. The table of contents is cross-referenced from less-commonly used names to the main entry, and a geographical index is included. (C.H.)

7923 IOP-3

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

NRX REACTOR RESEARCH FACILITIES. Facilities Available, Design Requirements, Services Available, and Approved Instruments. Aug. 1955. 21p. (AECL-215)

Canada's 40-Mw NRX Reactor, with its high neutron flux and large reacting core, provides a wide range of experimental facilities. It permits the irradiation of samples for physical, chemical, and biological research purposes; it provides neutron beams for the nuclear physicist; and it allows for the testing under conditions simulating those to be found at full scale, of engineered systems for future nuclear reactors. Atomic Energy of Canada Limited makes extensive use of these facilities in its own research program and is willing, under certain conditions, to make them available to others. This memorandum summarizes the facilities available, both in the reactor and as auxiliary services, and specifies the general requirements of any proposed irradiation. The procedure to be followed in submitting applications and the pricing scale is given in a separate memorandum. (auth)

7924

WORKS OF THE U.S.S.R. ACADEMY OF SCIENCES ON URANIUM–GRAPHITE REACTORS. V. S. Fursov. p.15-38 in Plenary Meeting. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 106p. (In Russian)

This paper describes the first Soviet nuclear reactor. The results of research on a more powerful uranium-graphite reactor of the USSR Academy of Sciences are given. These results are important for the construction of other nuclear reactors, and particularly of the reactor of the atomic power station. The first Soviet nuclear reactor was a thermal neutron system using graphite as moderator and natural uranium as fuel. The reactor was not equipped for continuous removal of the generated energy. But because of the large thermal capacity of the system, short power increases to several thousand kilowatts with essential integral energy production were achieved. This made it possible first to obtain artificial isotopes in noticeable quantities and subsequently to supply them to other branches of science. The experience from the first reactor and the nuclear physics research carried out on it made it possible to undertake the designing and construction of other nuclear reactors. The appearance of nuclear reactors has stimulated the study of the modification of the properties of substances and materials under nuclear irradiation. These studies have revealed striking phenomena. Of particular interest was the behavior of the basic materials of the reactor, uranium and graphite, in the high radiation flux arising in the reactor when it is in operation. Very great changes due to this new physical factor were observed in the properties of the materials. Many interesting results were obtained on the changes of the properties of the other construction materials as, for example, steel organic insulators, etc. All these results were taken into account in designing other reactors, for example, the reactor of the atomic power station. (auth)

7925

INVESTIGATION OF THE PARAMETERS OF URANIUM–GRAPHITE HETEROGENEOUS SYSTEMS BY THE PRISM METHOD. L. V. Groshev, O. I. Kozinets, L. E. Lazareva, K. D. Tolstov, E. L. Feinberg, I. M. Frank, F. L. Shapiro,

and I. V. Shtranikh. p.21-52 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

The buckling χ^2, the multiplication factor κ, and the thermal utilization factor θ in a uranium-graphite heterogeneous system with constant slug diameter were investigated as a function of the uranium concentraction C. The experiments were performed on a $180 \times 180 \times 420$ cm^3 cadmium shielded prism. A set of equidistant channels in the graphite was secured. They could be filled either with uranium slugs or with graphite rods. The uranium concentration in the prism could be varied by removal of the metal from the channels. An atomic concentration of the metal $N_f/N_c = 0.013$, corresponding to a lattice spacing of about 20 cm was accepted as unity. The diameter of nearly half of the channels was greater than that of the others, thus securing the formation of circular air gaps around the slugs in these channels. The difference in measurements for uranium slugs transferred from one kind of channel to the other enabled determination of the "gap effect." The values of χ^2 and κ were determined by the exponential method. These quantities revealed a flat maximum at $C \simeq 0.8$. They tend to zero and unity, respectively, at $C = 0.3$ and $C = 1.9$. θ was obtained from the cadmium ratio measurements. The empirical formula $1-\theta/\theta = (g/C)-h$, where g and h are constants, was obtained. This agrees with the results of the diffusion theory, taking into account the experimental values of the mean neutron velocities in a graphite-uranium system. The ratio κ/θ was found to be linearly dependent on the concentration. By extrapolating it to $C = 0$, κ may be split into two empirical factors: 1) ν_1 i. e., the number of neutrons generated per thermal neutron captured, including the multiplication of fast neutrons; ν_1 turned out to be 1.34 ± 0.02 (for such a method of splitting ν_1 partially includes the radiative capture); 2) φ i. e., the probability of fission neutrons reaching the thermal energy region. Thus, $1-\varphi$ represents the radiation capture in U partially compensated by epicadmium U^{235} fission. It is also a linear function of the concentration. The effects of the water jackets surrounding the slugs, as well as that of air gaps, imitating possible types of cooling, were investigated. At $C < 1.5$, water has a negative effect on κ. At $C > 1.5$, the water effect has the opposite sign. The separate effects of water on θ and φ are discussed. The water and air gap effects turned out to be smaller than those expected according to the elementary diffusion theory. This may be ascribed to the insufficiency of the one-velocity-group treatment. (auth)

7926

MEASUREMENT OF TEMPERATURE EFFECTS IN URANIUM–GRAPHITE SUBCRITICAL SYSTEMS. B. P. Ad'yasevich, I. M. Frank, O. I. Kozinets, F. L. Shapiro, I. V. Shtranikh, and K. D. Tolstov. p.132-55 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

For the purpose of investigating the temperature effects of the multiplication constant $\kappa_\infty = \nu_1 \varphi \theta$, as well as of the factors composing it, two $120 \times 120 \times 260$ cm^3 prisms, each placed in its own thermostat, heated up to 300-450°C were used. A study was made of uranium-graphite lattices (slug diameter 32-37 mm) with various uranium concentrations. The thermal utilization factor θ, measured by the "cadmium ratio" method, reveals a positive temperature effect which increases with decreasing uranium concentration. This effect is particularly high in the presence of cooling water. The elementary diffusion theory predicts this effect, giving, however, too high values in the absence of water and too low values in the presence of water. The causes of the discrepancies are discussed. It is shown that a considerable contribution to the temperature effect is due to an increase of θ, produced by the cooling of neutrons in water when entering the slug. Experiments showed also that the positive effect on θ increases if the cooling is extended over a layer of graphite adjacent to the slug. Unhomogeneous heating of the moderator allows, in principle, to increase the θ of a heterogeneous system above that of a homogeneous one, with the same concentration of uranium. In order to separate the temperature effect on φ, cold and hot (~ 80°C) water was alternatively circulated through the tubes, containing uranium slugs, the graphite temperature being kept constant. Variation of φ was obtained from exponential measurements of the buckling χ^2, as well as from measurements of the influence of heating on the epicadmium neutron density in the vicinity of the source. The temperature effect on κ_∞ was determined through measurements of χ^2 by the exponential method. The temperature dependence of ν_1 was found by subtracting the contributions due to the variation of φ and θ from the temperature effect on κ_∞. It turned out that ν_1 has a negative temperature effect, approximately proportional to the variation of the mean energy of the thermal neutrons, caused by the heating of the system. The temperature effects on κ_∞ for several physical reactors, calculated on the basis of the results of the present investigation, agree satisfactorily with the published data of direct measurements. (auth)

7927

WORK ON U^{235} AND Pu^{239} REACTORS WITH HYDROGEN MODERATORS CONDUCTED AT THE ACADEMY OF SCIENCES OF THE U.S.S.R. G. N. Flerov. p.170-84 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

Results are presented of an experimental study of U^{235} and Pu^{239} hydrogen-moderated reactors. For reactors of cylindrical and spherical shape the critical-mass and critical-volume values were determined for different concentrations of fissionable materials (hydrogen to fissionable material concentration ratios from 2.6 to 600). In some experiments the fissionable material moderator systems under investigation were allowed to become supercritical with the power level rising up to 50 w. The influence of various reflectors (uranium, paraffin, iron, etc.) on the neutron multiplication factor in the reactor was studied. A method for the absolute measurement of the multiplication factor in reactors of different shapes has been developed. The neutron spatial distribution in the reactors was measured. Measurements of the neutron energy distribution in the range from 1 ev up to 345 ev were carried out for reactors with high concentrations of fissionable material. Estimates of the effective number of neutrons per capture, ν_{eff}, for Pu^{239} and U^{233} in intermediate-energy reactors were obtained by a comparative method. The experimental determinations of ν_{eff} in the intermediate

neutron energy region show that the prospects of using Pu^{239} hydrogen-moderated reactors for breeding purposes are poor. (auth)

7928

SOME PROBLEMS OF THE URANIUM–WATER LATTICE THEORY. S. M. Feinberg. p.185-216 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

Properties of U–water lattices have been studied. A theoretical investigation of the fast fission factor, μ, was based on an analysis of the kinetic equation for neutrons. Approximate formulas have been derived for μ. Experimental data for μ in a U-water lattice were found to coincide well with the theory. The age, τ, of fast neutrons was obtained from kinetic equation calculations made for homogeneous mixtures of U and water. Two methods of calculating τ are given. (M.P.G.)

7929

METHOD OF MEASURING FAST NEUTRON MULTIPLICATION FACTOR. G. A. Stolyarov, L. V. Komissarov, V. P. Katkov, and Yu. V. Kikol'skii. p.217-25 in Meeting of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

A method for measuring the fast neutron multiplication factor μ is described. Measurements of μ are given for a small uranium-water lattice in a uranium-graphite reactor and for experimental uranium-water reactors. The results of these measurements agree well with each other. The measurements for the small uranium-water lattice have been substantiated. The following formula has been derived for the fast neutron multiplication factor: $\mu = 1 + (N\,238/N\,235)[\nu\,238 - 1 - (\Sigma_r/\Sigma_f)/\nu\,235]$ where N 238/N 235 is the ratio of the fission numbers for the nuclei U^{238} and U^{235} in the lump, ν 238, ν 235 are the number of fast neutrons arising in the fission of the nuclei U^{238} and U^{235}, and Σ_r/Σ_f is the mean ratio of radiation capture and fission cross-sections for U^{238}. Two methods have been evolved for determining N 228/N 235. Both use layers of impoverished and natural uranium, which are placed in a slot in the uranium lump of the lattice under investigation. The first method consists in comparison of the β-activity of fission fragments collected on paper disks for impoverished and natural uranium. The second method consists in direct counting of fission fragments by means of two ionization chambers. (auth)

7930

ON APPROXIMATION METHODS OF CALCULATING NUCLEAR REACTORS. G. I. Marchuk. p.371-4 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

A brief, nonmathematical discussion of methods for solving the diffusion equations for various geometrics is presented. (G.Y.)

7931

NUCLEAR REACTOR CONTROL SYSTEMS UTILIZING SOLID STATE DEVICES. Stephen F. Malaker and Edward Rathje (Daystron Instrument, Archbald, Penna.). IRE Convention Record 3, Part 10, 218-23(1955).

With increased interest in reactors for commercial use, new approaches to the problems of reactor control are receiving attention. This report covers the use of transistor magnetic amplifiers as the servo amplifiers in a typical reactor control loop. Because of the inherent ruggedness and reliability of solid state devices this approach offers a potentially valuable control mechanism. Characteristics of actual servo loops are described, and the values of the amplifier parameters are discussed. (auth)

NUCLEAR TRANSFORMATION

7932

MEASUREMENTS OF THE AVERAGE NUMBER OF NEUTRONS EMITTED IN THE FISSION OF SOME URANIUM AND PLUTONIUM ISOTOPES. V. I. Kalashnikova, A. V. Krasnushkin, V. I. Lebedev, L. A. Mikaelyan, M. I. Pevzner, P. E. Spivak, and V. P. Zakharova. p.156-69 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

Relative measurements of ν, the number of emitted neutrons, for U^{233}, U^{235} and Pu^{239} were performed by a method of simultaneously counting the fissions produced by thermal neutrons in the material under investigation and the number of emitted neutrons. The ratio of ν (Pu^{241}) to ν (Pu^{239}) was determined by the coincidences between the fragment and the fission neutron. The following data were obtained: $\nu(U^{233})/\nu(U^{235}) = 1.03 \pm 0.01$; $\nu(Pu^{239})/\nu(U^{235}) = 1.19 \pm 0.01$; $\nu(Pu^{241})/\nu(Pu^{239}) = 1.04 \pm 0.01$. Direct comparison of ν in the thermal fission of Pu^{239} with ν_0 in the spontaneous fission of Pu^{240} showed that the number of fission neutrons depends notably on the excitation energy of the fissionable nucleus. It was found that ν (Pu^{239} + n) is about 30% higher than ν (Pu^{240}). An absolute estimation of ν was made by means of a calibrated source imitating the fission neutron spectrum. It was found that: $\nu(U^{233}) = 2.6$; $\nu(U^{235}) = 2.5$; $\nu(Pu^{239}) = 3.0$; $\nu(Pu^{240}) = 2.2$; $\nu(Pu^{241}) = 3.1$. The errors in the estimated values of ν are about 4%. (auth)

7933

NEUTRON YIELD FROM PHOTODISINTEGRATION OF URANIUM AND THORIUM. L. E. Lazareva, B. I. Gavrilov, B. N. Valuev, G. N. Zatsepina, and V. S. Stavinskii. p.306-21 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

The photodisintegration of uranium and thorium was investigated with the use of photons from a 30 Mev synchrotron. For bremsstrahlung photons with an upper energy limit varying from E_{max} = 6 Mev to E_{max} = 28 Mev, the yield of photoneutrons and the average ratio of neutron to fission yield were measured. For E_{max} = 18.5 Mev the yields of delayed neutrons accompanying the photodisintegration of U and Th were measured. The photoneutrons were moderated in paraffin and registered by a BF_3 ionization chamber. The yield of fission fragments was measured with the help of a differential parallel plate ionization chamber. The flux of bremsstrahlung photons impinging on the sample was deter-

mined by measuring the ionization within the air cavity of a thick walled aluminium chamber (7.5 cm). The curves obtained make it possible to calculate by the photon difference method the photoneutron cross-section curves (σ_n) and photo-fission cross-section curves (σ_f) for U^{238} and Th^{232}. The integrated cross-sections $\int_0(E = 28\ Mev/\alpha\ d\ E)$ (σde) are, respectively: U, 12.9 and 1.7 (Mev-barn); and Th, 6.6 and 0.64 (Mev-barn). Analysis of the curves obtained for σ_n and σ_f makes it possible to estimate the probability of U and Th fission at various energies of γ-ray excitation. For U the probability of fission (σ_f/σ_γ) varies from 0.2 to 0.3. For Th the probability of fission at 8 to 11 Mev energies is ~0.1 and increases up to 0.3 to 0.4 at higher energies. The yield of delayed neutrons in percent to the total neutron yield for an average excitation energy of ~12 Mev is, for uranium, 0.41 ∓ 0.02%, and for thorium, 0.18 ∓ 0.01%. (auth)

7934

RESULTS OF MEASUREMENTS OF THE EFFECTIVE NUMBER OF SECONDARY NEUTRONS FOR U^{233}, U^{235}, AND Pu^{239} IN THE PRIMARY-NEUTRON ENERGY RANGE FROM 0.2 TO 100 EV. B. G. Erozolimskii. p.369-70 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

Relative to the neutron production by thermal fission, taken as 1 for 0.025-ev neutrons, the following relative effective numbers of neutrons produced by primary neutrons of energies 0.15 to 0.5, 0.4 to 3, 0.6 to 6, 2.5 to 25, and 8 to 130 ev were found. U^{235}: 1.00 ± 0.03, 0.78 ± 0.02, 0.73 ± 0.02, 0.74 ± 0.02, 0.72 ± 0.02; U^{233}: 1.00 ± 0.02, 0.98 ± 0.02, 0.98 ± 0.02, 1.00 ± 0.025, 1.00 ± 0.025; Pu^{239}: 0.90 ± 0.02, 0.88 ± 0.02, 0.89 ± 0.02, 0.88 ± 0,02,-; respectively. The primary-neutron energy ranges were obtained by the use of various combinations of Cd, Gd, and B_4C filters. (G.Y.)

7935

NUCLEAR FISSION REACTIONS WITH π^- MESONS AND FAST PROTONS. N. A. Perfilov, N. S. Ivanova, O. V. Lozhkin, V. I. Ostroumov, and V. P. Shamov. p.79-96 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

The interaction of slow pions with U, Bi and W nuclei and of 460 and 660 Mev protons with the same nuclei, was studied by the thick-emulsion photographic plate method. The capture of slow pions by these nuclei causes their fission with probabilities of ~0.3 to 0.4, ~0.02, and ~0.002, respectively. Other cases of capture result in the evaporation of particles, chiefly neutrons. Uranium fission yields plotted against free paths for the case of slow pions fission exhibit a pronounced maximum, just as in the case of fast particle fission. This fact viewed in conjunction with the energy distribution of the light particles accompanying fission lends support to the mechanism of the interaction of pions with nuclei resulting in the formation of fast particles. The study of the interaction of 450- and 660-Mev protons with U, Bi and W nuclei has suggested a method of determining the excitation energy and produced data concerning the distribution of fissile nuclei with respect to initial excitation energies. The average excitation energies have also been determined for fissible U, Bi and W nuclei with 460- and 660-Mev protons. Distributions of fission product free paths as a function of the excitation energy were obtained for all these nuclei. They indicate that with an increase in the initial energy of the excitation of fissile uranium and bismuth nuclei from 100 Mev up there is an increase in the proportion of fissions unsymmetric with respect to free paths, which also corresponds to an increase in the number of fissions yielding products of unequal mass. Anisotropy was also observed in the angular distribution of the fission products, with a predominance of fission products at an angle of 90° to the path of the falling proton. An analysis of the U, Bi and W fissions reveals that fission of the investigated nuclei at high excitation energies is the final result that follows considerable cooling of the nucleus owing to the preceding evaporation of neutrons and charged particles. (auth)

7936

RADIOCHEMICAL STUDY OF THE FISSION PRODUCTS OF Bi, Th AND U UPON BOMBARDMENT WITH 480 MEV PROTONS. A. P. Vinogardov, I. P. Alimarin, V. I. Baranov, A. K. Lavrukhina, T. V. Baranova, F. I. Pavlotskaya, A. A. Bragina, and Yu. V. Yakovlev. p.97-119 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

The products of the bombardment of Bi, Th and U with 480-Mev protons were studied. The distribution curve of the cross section of radioisotope formations consists of three sections, which correspond to the different nuclear reactions: the emission of light nuclei, the spallation of nuclei, and the fission of nuclei. The process of Bi, Th and U nuclear fission was found to exhibit the following specific features: (1) the fission yield curve is a symmetric curve with a single maximum; (2) no radioactive fission products with long decay chains are formed; (3) many neutron-deficient fission products are formed; (4) the fission products to the left of the maximum are β active; the ones to the right are β^+ active or undergo K capture. The total cross section of the fission of uranium nuclei bombarded with 480-Mev protons is equal to about $2 \cdot 10^{-24}$ cm^2, i. e., is close to the geometric section. The total cross section of the fission of thorium nuclei under the action of 480-Mev protons is equal to $1.5 \cdot 10^{-24}$ cm^2. The total cross section of the fission of bismuth nuclei is equal to $7 \cdot 10^{-26}$ cm^2, which corresponds to 0.03% of the geometric cross section. This quantity is in good agreement with the value $6 \cdot 10^{-26}$ cm^2 obtained by V. P. Jelepov, B. M. Golovin and Y. A. Kazarinov by applying the ionization method to the fission of bismuth bombarded with 400-Mev neutrons. A comparison with the data of Goeckerman and Perlman for the fission of Bi bombarded with 190-Mev deuterons points to a certain shift of the maximum towards elements with lower atomic numbers with an increase in the energy of the bombarding particles. The maximum yield corresponds to a preliminary emission of ~16 neutrons and ~2 protons, this being evidence of the emitting fission of bismuth nuclei. Hitherto unknown radioistopes of cerium and bismuth corresponding to Bi^{202}, Bi^{206}, and Ce^{134} were found in the products of uranium bombardment. (auth)

7937

A RADIOCHEMICAL STUDY OF THE FISSION OF TUNGSTEN WITH 280-MEV DEUTERONS. B. V. Kurchatov, V. N. Mekhedov, M. Ya. Kuznetsova, and L. N. Kurchatova. p.120-

31 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

The composition and yields of products from the splitting of tungsten with 280-Mev deuterons in the region of medium atomic number elements were determined. The investigation was carried out in 1950-1951. Specially refined WO_3 free from admixtures capable of distorting the investigated effect was used for the experiment. The results of this work are given in a table. The yields are given relative to W^{185}. The cross-section of the formation of W^{185} is about $\sim 10^{-27}$ cm^2. Distribution of the products according to mass and atomic number indicates the symmetric fission of the tungsten with some asymmetric fission. The number of neutrons emitted before or after fission is estimated by the neutron-proton ratio in the fission products. The formation of fragments in the maximum yield region ($\sigma \simeq 10^{-28}$ cm^2) is accompanied by the emission of 10 to 13 neutrons. The results are interpreted as the superposition of fission with preliminary emission of a sufficient number of neutrons and fission from the excited level. The formation of some fragments with a great lack of neutrons is considered as a distinguishing feature of high energy fission. (auth)

7938

RADIOCHEMICAL STUDY OF PRODUCTS OF HIGH ENERGY SPALLATION OF COPPER AND BISMUTH. A. P. Vinogradov I. P. Alimarin, V. I. Baranov, A. K. Lavrukhina, T. V. Baranova, and F. I. Pavlotskaya. p.132-59 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

The spallation products of copper nuclei bombarded with 280 Mev deuterons and 480 Mev protons, as well as of bismuth nuclei bombarded with 480 Mev protons, were studied by the radiochemical method. The shape of the distribution yield curves of the residual nuclei versus mass number made it possible to establish a great variety of nuclear processes, namely, the emission of light nuclei, the fission and spallation of nuclei, and secondary reactions increasing the atomic number of the initial nucleus. A study of the radioactive products of copper spallation under the action of 480 Mev showed that neutron deficient nuclei prevail among these products. However, only β-active nuclei were detected in the case of radioisotopes with $Z \leq 20$. The total cross section of the formation of radioactive products was found to be equal to $0.22 \cdot 10^{-24}$ cm^2. The spallation products of bismuth bombarded with 480 Mev protons were studied in 1952. It was found that the principal specific feature of this process is the predominant formation of nuclei with a marked neutron deficiency. The yield of lead, mercury and platinum isotopes increases with the decrease in their mass numbers. The cross section of bismuth spallation is equal to about 1.10^{-24} cm^2. This quantity indicates that bismuth spallation dominates over the process of fission of the same nuclei (σ spallation/σ fission = 15). The following hitherto unknown radioisotopes of mercury were discovered among the spallation products: Hg^{191}, Hg^{192}, Hg^{193}, Hg^{195}, and Hg^{195m}. The formation of the radioisotope Ga^{66}, was detected when copper was bombarded with 480 Mev protons. This is evidence of nuclear reactions with secondary particles, which increase the atomic number of the initial nucleus. A study of the Ga^{66} yield as a function of proton energy confirms this mechanism of the reaction. The cross section of the secondary reaction $Cu^{63}(\alpha,n)Ga^{66}$ is equal to $3.1 \cdot 10^{-29}$ cm^2. (auth)

7939

SPALLATION REACTIONS OF MEDIUM AND HEAVY NUCLEI (Cu, La, Bi). A. N. Murin, B. K. Preobrazhenskii, I. A. Yutlandov, and M. A. Yakimov. p.160-77 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

The products of fast proton interaction with the nuclei of separated copper isotopes, ordinary copper (proton energy 660 Mev), lanthanum (proton energy 480 Mev) and bismuth (proton energies 480 and 660 Mev) were chemically separated and identified. The cross-sections for the formation of the reaction products were determined for copper and bismuth, and the relative yields, for lanthanum. It was shown that neutron deficient nuclei are preferentially formed. An increase in energy shifts the maximum of the reaction product yield towards lower Z and for a given mass number, towards the line of isotope stability. The average charge and mass number was determined in spallation reactions of lanthanum and bismuth for different energies of the bombarding particles. An estimate of the average value of the excitation of intermediate nuclei yields a quantity of the order of 90 Mev (E_p = 660 Mev) for bismuth. The ratios of the cross-sections of spallation reactions (σ_{spall}) to the cross-section of fission reactions (σ_{fiss}) for bismuth were found to be equal to $\sigma_{spall}/\sigma_{fiss} \cong 20$ (E_p = 480 Mev) and $\sigma_{spall}/\sigma_{fiss} \cong 15$ (E_p = 660 Mev). It was established that fission is preceded on the average by the emission of 17 neutrons and 1 to 2 protons. A comparison of the cross-sections for the formation of individual fission products for bombarding proton energies of 480 Mev and 660 Mev points to an increase in the proportion of asymmetric fission as the energy rises. The cross-sections of the reactions Cu^{63} (p, 4α, 2 p, n) Ca^{45} and Cu^{65} (p; 4α, 2 p, n) Ca^{47} were found to be different. The following isotopes which were unknown when the present work was being done, were discovered; Ce^{134} (T = 2.2 days), Cs^{128} (T = 2.5 mins.), Pt^{188} (T = 10.3 days). (auth)

7940

RADIOCHEMICAL STUDIES OF SPALLATION PRODUCTS OF SILVER WITH HIGH-ENERGY PARTICLES. B. V. Kurchatov, V. N. Mekhedov, N. I. Borisova, M. Ya. Kuznetsova, L. N. Kurchatova, and L. V. Christyakov. p.178-204 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

This paper presents the composition and yields of the spallation products of silver bombarded with 550-Mev alpha-particles, 280-Mev deuterons and 480-Mev protons. The experimental part of the work was carried out in 1950-1952. Highly pure silver was used in the experiment. With few exceptions the isotopes of the elements from gallium to cadmium decay by positron emission or electron capture. The yields of 70 proton spallation products have been determined. The yields rapidly decrease with the atomic number, pass through a minimum in the region of Z ≅ 25–28, and

after a certain increase become relatively constant for the region Z = 6–15. The yield of undetermined isotopes was interpolated by yield curves for nuclei of the same isotopic number (I–N—Z). This gave a picture of the yields of all the spallation products. The isotope yields of each element (in the Z = 32 to 46 range) are represented by a bell-shaped curve approximately expressed by the following formula: $Lg\ X_0 - Lg\ X = 0.17/N_0 - N/^{1.6}$ where X_0 is the yield and N_0 is the isotope neutron number at the top of the curve. (auth)

7941

RADIOCHEMICAL RESEARCH OF NUCLEAR TRANSFORMATION PRODUCTS OF HIGH ENERGY PARTICLE BOMBARDMENT. A. P. Vinogradov. p.60-79 in Plenary Meeting. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 106p. (In Russian)

This paper deals with the principal experimental results obtained from radiochemical research of nuclear transformation products of high energy particle bombardment, conducted from 1950 to 1952 and, subsequently, with the aid of the synchrocyclotron of the Institute of Nuclear Problems of the USSR Academy of Sciences. A detailed study was made of the transformation of the products of U, Th, Bi, Ag, Cu, W, and La, formed by the action of protons as well as neutrons, and α-particles with energies of between 280 to 680 Mev. Distribution curves of the fragment and residual nuclei yield, data concerning mass numbers and other data were obtained. The nuclear fission of the heavy elements at the end of the Mendeleyev periodic system, under bombardment by low and high energy particles was observed. The difference in the character of this process as depending on the energies of the particles was indicated. The process of nuclear spallation in heavy elements at high energies and the relation between the processes were studied in nuclei of medium and light atomic numbers. Indicated also were the changes in character of the nuclear transformation product yield, depending on the position of the chemical element in the Mendeleyev periodic system, the energies of the particles and other conditions. By interpolation, results were obtained of the yield of all residual nuclei, including short-lived radioactive and stable isotopes for the spallation products of Cu and Ag. A particular study has been made of the probable mechanism of the appearance of light nuclei and nuclei with an atomic number higher than that of the irradiated nucleus. Individual nuclear reactions have been studied. A great number of new radioactive isotopes were detected. Diagrams are given of the distribution of β^-- and β^+-active nuclei in the A = 2Z to Z system and some regularities of this distribution have been considered. Possibilities of applying the radiochemical method for solving problems of nuclear transformation under bombardment by high energy particles were investigated. The conclusion contains an outline of the results of all the works known in this field and the prospects of these researches in the near future. Emphasis is laid on the importance of these researches for an understanding of the methods of nuclear formation and of the causes of their different widespread effects. (auth)

7942

THE GAMMA RADIATION FROM THE REACTION $D(p,\gamma)^3He$. G. M. Griffiths and J. B. Warren (Univ. of British Columbia, Vancouver, Canada). Proc. Phys. Soc. (London) A68, 781-92(1955) Sept. 1.

Using a scintillation counter for the measurement of the gamma radiation, the Q value of the reaction $D(p,\gamma)He^3$ was found to be 5.50 ± 0.03 Mev. The Doppler shift has been measured. The angular distribution was found to be nearly a pure $\sin^2\theta$ pattern at all proton bombarding energies from 0.5 to 2 Mev, but evidence has been obtained for a small isotropic component. Neutrons were detected, arising via the $D(d,n)He^3$ reaction, from the knock-on deuterons. The relative yield curve has been measured with a thin target and is in accord with the formula given by Fowler and his co-workers. An approximate measurement of the absolute cross section at E_p = 1.0 Mev gave 4×10^{-30} cm^2 ± 50%. (auth)

7943

RANGE ESTIMATIONS OF RECOIL ATOMS P^{32} AND S^{35} THROWN OUT IN THE REACTION n,α AND n,p ON CHLORINE. Pierre Sue (College de France, Paris). J. phys. radium 16, 734-5(1955) Aug.-Sept. (In French)

An attempt has been made to separate the radioelements P^{32} and S^{35} resulting from the $Cl^{35}(n,\alpha)P^{32}$ and $Cl^{35}(n,p)S^{35}$ reactions. The mean values of ranges in NaCl for fast neutrons are estimated at: P^{32} = 0.5 ± 0.2μ and S^{35} = 0.05 ± 0.03μ. (B.J.H.)

PARTICLE ACCELERATORS

7944 COO-177

Purdue Research Foundation, Lafayette, Ind.

BASIC RESEARCH WITH HIGH ENERGY ELECTRONS AND X-RAYS PRODUCED BY A 300 MEV SYNCHROTRON. PROGRESS REPORT. June 30, 1955. 40p. Contract AT(11-1)-123.

During the past fiscal year the Purdue electron synchrotron has continued to operate with reasonable reliability for conducting nuclear research with high-energy protons. Various experimental techniques have been employed, primarily scintillation counter telescopes, ionization chambers, a Wilson cloud chamber, and nuclear emulsion plates. Basically, the investigations can be classed either as photoproton (γ,p) studies or those concerned with photomeson production. During the year new items of research equipment such as a liquid hydrogen (or deuterium) target have been completed and placed into use in the research program. Likewise, as time permitted, a continuing effort to improve efficiency of accelerator operation was carried out, such as the acquisition of additional capacitors for the large capacitor bank and further development of a plastic "donut" vacuum tube. Plans for the future include utilization of all research facilities now assembled to accelerate the research programs, particularly regarding photomeson and photoproton studies. (auth)

7945

A STUDY OF A VARIABLE FREQUENCY CYCLOTRON RESONANT SYSTEM. M. R. Donaldson, R. E. Worsham, and N. F. Ziegler (Oak Ridge National Lab., Tenn.). IRE Convention Record 3, Part 10, 191-8(1955).

A conceptual cyclotron design is considered which allows operation at a number of discrete frequencies in the 5.9 to 8.7 megacycle range. Tuning is accomplished by variable parallel-plate capacitors, and the effect of the capacitors has been determined from model measurements. To provide for movement of the capacitor plates, a novel sliding, pneumatically operated, r-f connection has been developed and tested. (auth)

7946
BEVATRON OPERATION. Dick A. Mack (Univ. of California, Berkeley). IRE Convention Record 3, Part 10, 199-203(1955).

Particle accelerators in the Bev range have substantially extended the scope of nuclear research by providing a better understanding of the interactions between high-energy particles. The Bevatron, a proton synchrotron at the University of California Radiation Laboratory, was placed in operation in February, 1954. Since that time numerous tests and engineering changes have improved the continuity of operation and the uniformity of accelerated beam pulses. Recently a beam of 10^{10} protons per pulse has been accelerated to the energy of 6.1 billion electron volts (Bev). Among factors contributing to the increases in the number of particles accelerated have been small corrections in the gradient of the guiding magnetic field, a decrease in the effects of leakage magnetic fields on sensitive circuits, and improved monitoring methods which permit a better understanding of beam dynamics. Refinements in engineering design and preventive maintenance are in progress to increase the usefulness of the Bevatron as a research tool. (auth)

7947
CRYOSTAT FOR CYCLOTRON IRRADIATION AT LIQUID HELIUM TEMPERATURES. D. E. Mapother and F. E. L. Witt (Univ. of Illinois, Urbana). Rev. Sci. Instr. 26, 843-6 (1955) Sept.

A description is given of a cryostat which has been developed for cooling small specimens with liquid helium while they are subjected to irradiations of several days duration in a cyclotron beam. The cryostat is fabricated for the most part from commercially available sheet-metal parts and consists essentially of a liquid helium vessel shielded by a liquid nitrogen cooled envelope. The intrinsic loss rates for refrigerants with this apparatus are about 5 liters per day of liquid nitrogen and 600 cc of liquid helium per day, but considerably larger loss rates are encountered during periods when the cyclotron beam is on. The performance of the cryostat during irradiation experiments is discussed. (auth)

7948
CYCLOTRON ION SOURCE FOR THE PRODUCTION OF N^{3+}. H. L. Reynolds and A. Zucker (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 26, 894(1955) Sept.

Construction and design requirements for a cyclotron N^{3+} ion source are described in detail. Internal cyclotron beams of 100 μ amps at 24 Mev have been obtained. (B.J.H.)

RADIATION ABSORPTION AND SCATTERING

7949 NP-5774
Maryland. Univ., College Park.
ANGULAR DEPENDENCE OF THE CHARACTERISTIC ENERGY LOSS OF ELECTRONS PASSING THROUGH METAL FOILS. Technical Report No. 21 [for] January 1–June 30, 1955. Physics Dept. Richard A. Ferrell. Sept. 1955. 37p. Contract Nonr-594(00).

The Bohm-Pince electron plasma theory is employed to give a theoretical interpretation of some experimental results of Marton et al on the scattering of 20-kev electrons by a thin gold foil. General criteria are presented which can in principle select in any given case between the alternative mechanisms of collective excitation or one-electron excitation. For the general case of collective excitation, the scattering law is derived and used in a numerical analysis of the experimental data. Agreement with the Bohm-Pince theory is satisfactory. (auth)

7950 AEC-tr-2256
MARKOV'S METHOD AND PROBLEMS IN THE FLUCTUATION OF ENERGY LOSSES INCIDENT TO A LIMITED NUMBER OF COLLISIONS. V. V. Chavchanidze. Translated from Zhur. Eksptl'. i Teoret. Fiz. 26, 185-8(1954). 4p.

Markov's method is applied to the problem of the fluctuation of the energy losses of a particle passing through matter in the case when the number of collisions is small. A procedure is developed for finding the loss distribution function for the case when the loss in each individual collision is large. (auth)

RADIATION EFFECTS

7951 NAA-SR-1459
North American Aviation, Inc., Downey, Calif.
THE PRODUCTION OF ATOMIC DISPLACEMENTS BY HIGH ENERGY PARTICLES. J. A. Brinkman. Oct. 15, 1955. 52p. Contract AT-11-1-GEN-8.

The processes by which atoms in solids are displaced from their normal positions by high-energy neutrons, cyclotron particles, and electrons are discussed. A radiation damage model is presented which involves two basic features: (1) the production of interstitial atoms and vacant lattice sites, and (2) the production of displacement spikes. These two concepts are sufficient to account for most of the observed property changes resulting from atomic displacement by high energy particles. Some of the experimental results which provide the most direct support for these concepts are presented. (auth)

7952
CHANGE OF THE PROPERTIES OF GRAPHITE WHEN IRRADIATED BY NEUTRONS. V. I. Klimenkov and YU. N. Aleksenko. p.322-41 in Meetings of the Division of Physical-Mathematical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 376p. (In Russian)

The results are presented of measurements of the electrical and thermal conductivity, the Young modulus, the hardness, and size of graphite samples irradiated with a neutron flux up to the integral dose nvt = 10^{21} cm^{-2}. Irradiation was carried out in a nuclear reactor yielding a flux nv = 2×10^{13} cm^{-2} sec^{-1}. A strong change of the properties mentioned was noted (the electrical resistance of the samples increased 3 to 3.5 times, the Young modulus and hardness, 2 times, the thermal conductivity in some cases decreased 20 times). At the same time an increase of the specific volume by several per cent was observed. The X-ray structure investigation showed noticeable changes in the graphite structure due to irradiation. The annealing of irradiated samples showed that regeneration of the graphite begins at temperatures insignificantly exceeding the temperature at which the irradiation was carried out and is completed only at 2000°C. It was established that the annealing takes place partially at 200 to 300°C, but the main process begins only at 1000 to 1100°C. The activation energy for annealing at 200 to 300°C and the

energy yielded were determined. The experiments give grounds to estimate the dependence of irradiation effects in graphite on the temperature of irradiation and the spectra of neutrons On the basis of the measurements it may be supposed that irradiation effects in the graphite structure may be described as consisting of the formation of a solid solution of interstitial carbon atoms in the graphite lattice and of degraphitization. (auth)

7953

STUDY OF SOME PHENOMENA OBSERVED IN METALLIC SAMPLES IRRADIATED IN AIR BY DEUTERONS OF ABOUT 3 MEV. A. Kohn and J. Doumerc. J. phys. radium 16, 649-53(1955) Aug.-Sept. (In French)

The validity of a method for determination of traces of carbon in samples of iron is examined by a short irradiation in a beam of 3-Mev deuterons. The principal phenomenon to avoid is the adsorption of radioactive gases in the air by metallic samples. (tr-auth)

7954

EFFECT OF PROTON IRRADIATION UPON THE ELECTRODE POTENTIAL OF TUNGSTEN. M. Simnad and R. Smoluchowski (Carnegie Inst. of Tech., Pittsburgh, Penna.). Phys. Rev. 99, 1891-2(1955) Sept. 15.

The effect of proton irradiation on the electrode potential of tungsten has been measured in aqueous salt solutions. The results indicate that the effect of irradiation is much greater than the effect of severe cold work. In all cases the potentials of the irradiated specimens are anodic to the annealed specimens, which means that irradiation makes the tungsten more reactive chemically. (M.P.G.)

RADIOACTIVITY

7955

ON A NEW METHOD OF STUDYING RADIOACTIVE PHENOMENA: CINE-NUCLEOGRAPHY. M. Marcel Laporte (Institut du Radium, Paris). J. phys. radium 16, 659-74 (1955) Aug.-Sept. (In French)

A new application of the method of cine-nucleography is given. It is shown that by examination of a nuclear plate, irradiated by a moving source of an active thorium deposit, it is possible to determine the half life of thorium C. (tr-auth)

7956

INDUSTRIAL USE OF BREMSSTRAHLUNG RADIATION. P. Leveque and P. Martinelli (Centre d'Etudes Nucleaires de Saclay, France). J. phys. radium 16, 729-30(1955) Aug.-Sept. (In French)

It is suggested that pure β-emitting sources in conjunction with screens of various materials would provide low-energy x-ray sources. The industrial uses of several such sources are discussed briefly. (B.J.H.)

SHIELDING

7957 WASH-292(Pt.3)

Division of Reactor Development, AEC.

REACTOR SHIELDING INFORMATION MEETING, MAY 12-13, 1955, ENGINEER RESEARCH AND DEVELOPMENT LABORATORIES, FORT BELVOIR, VIRGINIA. PART 3. Sept. 1955. 81p.

The following papers presented at the shielding information meeting are included in Part 3: Attenuation of Gamma-Ray Dose Rate and Thermal-Neutron Flux from the BSR through Large Thicknesses of Water, by J. D. Flynn; The Energy Spectrum of Gamma Rays Accompanying the Fission of Uranium^{235}, by R. W. Peelle; Some Stratified Media Transport Problems Suitable for Machine Calculation, by F. H. Murray; Investigation of the Hornyak Button as a Fast-Neutron Dosimeter, by F. J. Muckenthaler; Prompt Fission Gamma-Rays from Uranium-235, by Roger L. Gamble; SSN571 Shield Test; Shielding Program at NRL, by L. A. Beach; Monte Carlo Calculation of Neutron Slowing Down; Properties of Lithium Hydride for Shielding Purposes, by Charles E. Slesser and Thomas R. P. Gibb, Jr.; Recent Results with N^{17} Neutrons, by Kalman Shure and Paul A. Roys; Thermal and Fast Neutron Effects in Bent Ducts, by F. J. Shore and R. D. Schamberger; Ray Analysis of the Transmission of Fast Neutrons through Cylindrical Ducts in Water, by R. E. Beneson and Y. Shimamoto; and Cross Sections with a Collimated Fission Neutron Source, by R. D. Schamberger and F. J. Shore. (M.P.G.)

SPECTROSCOPY

7958 AD-50022

COLLISIONAL BROADENING OF SPECTRAL LINES AND DISTINCTNESS OF QUANTUM STATES. (Stossverbreiterung von Spektrallinien und Schärfe der Quantenzustände). G. Hettner. Translated by James Gough, Jr. from Physik. Z. 27, 787-9(1926). 8p.

7959

SPECTROSCOPY OF THE ATOMIC NUCLEUS. L. V. Groshev and I. S. Shapiro. Moscow, Gostekhizdat, 1952. 440p. (In Russian) (Book on display at Geneva Conference)

A detailed monograph on the methods of investigating α, β, and γ radiations, as the basis of nuclear spectroscopy, experimental results obtained by these methods. Discussion of problems connected with the complex structure of the nucleus. (publisher's note)

7960

NUCLEAR AND PARAMAGNETIC RESONANCE. J. N. Shoolery and H. E. Weaver (Varian Associated, Palo Alto, Calif.). Ann. Rev. Phys. Chem. 6, 433-56(1955).

Current research in nuclear magnetic resonance and paramagnetic resonance is summarized. Among the topics reviewed were relaxation phenomena, molecular structures, nuclear spins and magnetic moments, irradiation of solids, and paramagnetism in metals, transition elements, and organic free radicals.

7961

LOW-FREQUENCY ROTATIONAL SPECTRUM OF HDO. Samuel Weisbaum, Yardley Beers, and Gabriel Herrmann (New York Univ., N. Y.). J. Chem. Phys. 23, 1601-5(1955) Sept.

In the region between 475 and 3500 Mc/sec one P-branch and five Q-branch lines in the spectrum of HDO have been completely measured and identified. These data have contributed materially to an evaluation of the structural constants of the molecule. From the data obtained by this and other microwave spectroscopy projects we have computed the principal moments of inertia, respectively, as having the values of 1.1982, 3.0862, and 4.3887 in units of gm cm^2 $\times 10^{-40}$. In addition, the shape of the $3_2 \rightarrow 3_3$ line at 824.64 Mc/sec has been extensively studied. At low pressure the wings of

the line have been shown to be wider than is consistent with the Lorentz line shape probably due to the presence of sattelite lines arising from the hyperfine splitting of the energy levels by the quadrupole moment of the deuteron. The observed effects are consistent with a quadrupole coupling constant of 272 ± 90 kc/sec with respect to an axis along the O–D bond. (auth)

7962

FORCE CONSTANTS, INFRARED SPECTRUM, AND THERMODYNAMIC PROPERTIES OF $TiCl_4$. N. J. Hawkins and D. R. Carpenter (Knolls Atomic Power Lab., Schenectady, N. Y.). J. Chem. Phys. 23, 1700-2(1955) Sept.

The spectrum of gaseous titanium tetrachloride was obtained in the rock salt and potassium bromide regions of the infrared. The thermodynamic functions C_p^0, S^0, and $-(F^0-E_0^0)/T$ were calculated. The orbital valence force field constants were computed, and lead to the conclusion that hybridization changes may be significant in the F_2-vibrations. (auth)

7963

VIBRATION-ROTATION BAND ν_2 OF HEAVY WATER VAPOR. Fred P. Dickey and James M. Hoffman (Ohio State Univ., Columbus). J. Chem. Phys. 23, 1718-20(1955) Sept.

The vibration-rotation band ν_2 in the heavy water vapor (D_2O) spectrum has been remeasured. An analysis of the rotational structure has been carried out. From the interpretation of the data the band center, as well as the value of the reciprocals of inertia have been determined. The band center is found to be 1178.45 cm^{-1} and the reciprocals of inertia are A(V) = 16.650 cm^{-1}, B(V) = 7.345 cm^{-1}, and C(V) = 4.795 cm^{-1}. (auth)

7964

LEAST-SQUARES CALCULATION OF OVFF FORCE CONSTANTS FOR XY_4 TETRAHEDRAL MOLECULES. William S. Horton (Knolls Atomic Power Lab., Schenectady, N. Y.). J. Chem. Phys. 23, 1727(1955) Sept.

The validity of the use of the least-squares method for the determination of the orbital valence force field (OVFF) constants is discussed. (C.W.H.)

7965

PARAMAGNETIC RESONANCE OF X-IRRADIATED TEFLON EFFECTS OF ABSORBED OXYGEN. William B. Ard, Howard Shields, and Walter Gordy (Duke Univ., Durham, N. C.). J. Chem. Phys. 23, 1727-8(1955) Sept.

The change of magnetic resonance with aging was shown to be a result of O_2 adsorption on the x-irradiated Teflon. The central resonance observed was due to the adsorbed O_2. (C.W.H.)

7966

NOTE ON THE X-BAND MICROWAVE SPECTRUM OF HEAVY WATER. D. W. Posener (Commonwealth Scientific and Industrial Research Organization, Sydney, Australia). J. Chem. Phys. 23, 1728-9(1955) Sept.

Attempts failed to detect the absorption line for the $5_{32} \rightarrow 4_{41}$ transition of D_2O as reported by Crawford (J. Chem. Phys. 21, 2099(1953)). It was conjectured that the Crawford "line" was due to formaldehyde impurities. (C.W.H.)

7967

CHLORINE NUCLEAR QUADRUPOLE RESONANCE IN SOLID SOLUTIONS. C. Dean (Univ. of Pittsburgh). J. Chem. Phys. 23, 1734-5(1955) Sept.

The Cl^{35} nuclear quadrupole resonance in p-bromochlorobenzene has been observed at room temperature in several solid solutions of that substance with p-dibromobenzene. (auth)

THEORETICAL PHYSICS

7968 AEC-tr-2255

CORRELATION FUNCTIONS IN THE THEORY OF THE BROWNIAN MOVEMENTS. P. I. Kuznetsov, R. L. Stratonovich, and V. I. Tikhonov. Translated from Zhur. Ekspti'. i Teoret. Fiz. 26, 189-207(1954). 20p.

Generalized correlation functions are used in the theory of the Brownian motion, which goes beyond the scope of the formalism of the Markov processes and of non-correlated random functions. A differential equation, generalizing the Focker-Planck equation, is derived for the case of a sufficiently short correlation time. It is shown that in particular cases the theory developed becomes the conventional theory of the Brownian movements. (auth)

7969 AEC-tr-2270

THE DERIVATION OF RELATIONS BETWEEN CROSS SECTIONS WHICH FOLLOW FROM THE HYPOTHESIS OF ISOTOPIC INVARIANCE. I. Shmushkevich. Translated by M. Hamermesh from Doklady Akad. Nauk S.S.S.R. 103, 235-8(1955). 8p.

A simple method is shown for obtaining relations between cross sections which follow from the hypothesis of isotopic invariance. The method shown requires nothing more than simple arithmetic operations. In particular, the scattering of π mesons by nucleons, the formation of single π mesons in nucleon-nucleon collisions, the formation of two π mesons in nucleon-deuteron collisions, the annihilation of nucleon-antinucleon pairs with the formation of two or three π mesons, and the decay of τ mesons into three π mesons are chosen to illustrate the method. (B.J.H.)

7970

ATOMIC PHYSICS. E. V. Shpolskiĭ. VOL. I. INTRODUCTION TO ATOMIC PHYSICS. VOL. II. ELECTRONIC SHELL OF THE ATOM AND THE ATOMIC NUCLEUS. Moscow-Leningrad, Gostekhizdat, 1951. Vol. I., 534p; Vol. II, 780p. (In Russian) (Book on display at Geneva Conference)

Vol. I. Experimental results of a study of atomic structure, and the basic principles of the atomic theory. Vol. II. A systematic outline of the fundamentals of quantum mechanics and its application in the study of the electronic shell of the atom. The atomic nucleus and cosmic rays. (publisher's note)

7971

ELECTROMAGNETIC PROPERTIES OF DEUTERON. Iwao Sato and Kiyomi Itabashi (Tohoku Univ., Sendai, Japan). Progr. Theoret. Phys. (Japan) 13, 341-59(1955) Apr. (cf. NSA 9-367)

The meson corrections to the magnetic dipole and electric quadrupole moments of a deuteron are calculated in the pseudoscalar meson theory with pseudovector coupling. These moments are expressed in the form $(\chi, U\chi)$, where χ is the Tamm-Dancoff amplitude for the deuteron, and U is the modified interaction operator between nucleons and an external electromagnetic field. U and normalization of χ are calculated to the fourth order in coupling constant. Renormalization of nucleon mass and coupling constant are performed non-relativistically. Numerical values of χ are taken from a paper of Brueckner and Watson. For the

magnetic moment, only the expression is given. For the electric quadrupole moment, the correction to the value of Brueckner and Watson, 2.83×10^{-27} cm^2 is found to be 0.285×10^{-27} cm^2. The previous calculations of Villars and Deser are criticized briefly. (auth)

7972

ON THE COMPETITION BETWEEN DECAY AND CAPTURE OF THE UNSTABLE PARTICLES DUE TO THE WEAK INTERACTIONS. Shuzo Ogawa (Nagoya Univ., Japan). Progr. Theoret. Phys. (Japan) 13, 367-79(1955) Apr.

In the transmutation processes of the unstable particles, some universal interactions seem to be recognized. In this note, the competition caused by these interactions between the decay and the nuclear capture of the unstable particles, when they stop in dense material. The competition is also investigated by the use of the assumed interactions in the case where the unstable particle is known to decay into π mesons, though little information is known on the nature of its interactions. It is found that the negatively charged τ meson, when brought into the K orbit of the heavy nucleus, is very likely to be absorbed by the nucleus before decaying. It is also noted that there is a certain correlation among the numerical values of the coupling constants of the weak interactions above introduced. (auth)

7973

ON HIGHER ORDER CORRECTIONS IN THE MESON THEORY OF NUCLEAR FORCES. Shigeru Machida and Kei Senba (Univ. of Hiroshima, Japan). Progr. Theoret. Phys. (Japan) 13, 389-404(1955) Apr.

Effects of higher order corrections to the second plus fourth order adiabatic nuclear potentials are discussed in the symmetrical pseudoscalar meson theory with pseudovector coupling, in order to make clear the region of its applicability. For that purpose, the sixth order adiabatic potentials have been calculated, where only such terms have been taken into account that mesons emitted by a nucleon are absorbed by another nucleon. Although the nuclear potential in the triplet even state changes its sign according as intermediate states with only two nucleons are included or not, the second pulse fourth order adiabatic potentials are not altered seriously by the inclusion of the sixth order effects in the "outside region" ($r \gtrsim 0.6 \sim 0.7/\mu$ where μ is the inverse Compton wave length for π meson). Effects of the binding of the two nucleons in the intermediate states are also estimated, which turned out to be unimportant in the "outside region." Accordingly, the second plus fourth order adiabatic potentials have a sufficiently large region of applicability for low energy phenomena. (auth)

7974

GENERAL FORMULA OF THE RACAH COEFFICIENT. Masachiyo Sato (Univ. of Tokyo). Progr. Theoret. Phys. (Japan) 13, 405-14(1955) Apr.

It is shown that the general formula of the Racah coefficient can be expressed symbolically as a binomial expansion by reducing the sum of fractions involved in the general formula given by Racah. Similar formulas to Biedenharn's are given for e = 3, 7/2, 4 and 9/2. (auth)

7975

NUCLEAR REACTIONS AT MODERATE ENERGIES AND FERMI GAS MODEL. Satio Hayakawa (Kyoto Univ., Japan), Mitsuji Kawai (Univ. of Tokyo), and Ken Kikuchi (Osaka Univ., Japan). Progr. Theoret. Phys. (Japan) 13, 415-41 (1955) Apr.

The cross section for nucleon-nucleon collisions in the nuclear matter is calculated in an analytical way on the basis of the Fermi gas model and the inverse-energy nucleon scattering cross section. The mean free path thus derived is found to be in qualitative agreement with those deduced from the phenomenological analyses of scattering experiments at low as well as at moderate energies. The angular and energy distributions of knock-out nucleons are calculated, and allow prediction of the contribution of such direct collisions to nuclear reactions. For the bombardment of 18-Mev protons on iron, this contribution to the energy spectrum of emitted protons is found far smaller than that from the evaporation process. Nevertheless, this influence is not negligible in deducing the nuclear temperature. For the bombardment of 31-Mev protons, the knock-out process can account for the gross behavior of high-energy nucleons observed in experiments. (auth)

7976

ON THE FOUNDATION OF THE UNIFIED NUCLEAR MODEL. I. Toshio Marumori, Jiro Yukawa, and Ryokichi Tanaka (Nagoya Univ., Japan). Progr. Theoret. Phys. (Japan) 13, 442-54(1955) Apr.

An attempt is made to give the foundation of the unified nuclear model which describes the nucleus as a system having a shell structure and capable of performing the oscillations in shape. A. Bohr's model is analyzed making use of the results obtained. Throughout the paper, emphasis is laid on making clear the physical image, and the more general mathematical procedure and the discussion concerning the the nuclear potential will be given in the forthcoming paper. (auth)

7977

ELASTIC PRODUCTION OF NEUTRAL PHOTO-PIONS IN HELIUM. Yoshio Yamaguchi (Univ. of Illinois, Urbana). Progr. Theoret. Phys. (Japan) 13, 459-61(1955) Apr.

The elastic photoproduction of neutron pions is discussed and numerical results based on the impulse approximation are presented. (auth)

7978

THE COLLISIONS OF NUCLEONS WITH DEUTERONS. A. H. de Borde and H. S. W. Massey (Univ. Coll., London). Proc. Phys. Soc. (London) A68, 769-80(1955) Sept.1.

A considerable amount of theoretical data (assuming central nuclear forces) is now available concerning the elastic scattering of nucleons with energies up to 16 Mev by deuterons. Buckingham, Hubbard and Massey have taken the force to be of exponential shape with range consistent with the binding energy of the deuteron and triton, while Christian and Gammel have used Yukawa and gaussian shape interactions with ranges consistent with all relevant two-body data, but which are considerably too short to give the correct binding energy of the triton on the assumption of purely central forces. In this paper the former calculations have been extended to allow fully for the contributions from high order phases. The dependence of the theoretical predictions on the assumptions made about the range, shape and exchange character of the nuclear forces is discussed in detail. It is shown that the observed data are inconsistent with the assumption of mainly ordinary forces, even for the least sensitive case of the short range gaussian interaction. Extension of the theory to include explicitly the tensor force is likely to be worth while as providing useful information about nuclear forces. (auth)

7979

THE ELECTROMAGNETIC FIELD IN A LAGRANGIAN

QUANTUM THEORY. K. V. Roberts (Univ. Coll., London). Phil. Mag. (7) 46, 941-50(1955) Sept.

The graphical rules of Feynman and Dyson are stated in a very general form, which depends only on the field Lagrangian and does not explicitly require either the use of field operators or the construction of a Hamiltonian scheme. It is shown that by choosing these rules as a starting-point one is able to quantize the electromagnetic field in a simpler way, since there is no longer any need to modify the classical Lagrangian $\frac{1}{4}F^{\mu\nu}F_{\mu\nu}$ (which does not lead to a Hamiltonian as it stands); to impose a supplementary condition; or to employ an indefinite metric. Dyson's theorem on photon propagation functions is established, and the gauge invariance of the S matrix is discussed. (auth)

TRACER APPLICATIONS

7980

METHODS OF WORK IN APPLYING RADIOACTIVE ISOTOPES. V. I. Spitsin, P. N. Kodochigov, M. M. Golutvina, A. F. Kuzina, and Z. A. Sokolova. Moscow, Akademiya Nauk S. S. S. R., 1955. 287p. (In Russian) (Book on display at Geneva Conference)

A manual for workers in research institutions and in industry having to deal with radioactive isotopes. A description of the properties of radioactive isotopes, methods of measuring α, β, γ radiations and rules for work with radioactive isotopes. Practical tasks in the application of radioactive isotopes in chemistry. A brief theoretical summary precedes each task. (publisher's note)

URANIUM AND URANIUM COMPOUNDS

7981 ANL-5482

Argonne National Lab., Lemont, Ill.

THE HIGH TEMPERATURE, HIGH VACUUM VAPORIZATION AND THERMODYNAMIC PROPERTIES OF URANIUM DIOXIDE (thesis). Raymond J. Ackermann. Sept. 14, 1955. 115p. Contract W-31-109-Eng-38. Submitted as a thesis to the Univ. of Kansas.

A high-temperature, high-vacuum investigation of the vaporization processes of UO_2 was carried out over a temperature range 1600 to 2800°K by means of the diffusion method. Results show that $UO_2(s)$ vaporizes congruently. Its heat of sublimation and the stability and dissociation energy of $UO_2(g)$ were established. The results of the mixture experiments were used to show that fragmentation is unimportant in the vaporization of $UO_2(s)$. Pronounced curvature of a log p vs. 1/T plot at temperatures above 2200°K can be interpreted in terms of the existence of a gaseous dimer, $U_2O_4(g)$. (auth)

7982

THE U^{233} FISSION YIELDS OF Nd AND Ce ISOTOPES. G. M. Kukavadze, M. P. Anikina, L. L. Gol'din, and B. V. Ershler. p.205-9 in Meetings of the Division of Chemical Sciences. Session of the Academy of Sciences of the U.S.S.R. on the Peaceful Use of Atomic Energy. July 1-5, 1955. Moscow, Publishing House of the Academy of Sciences of the U.S.S.R., 1955. 378p. (In Russian)

The U^{233} thermal neutron fission yields of various isotopes of Ce and Nd were determined mass-spectroscopically by the isotope dilution method. Yields obtained are tabulated. The errors given characterize the absolute accuracy of measurements. The yield ratios of Nd isotopes are determined with 2 to 3% accuracy and that of Ce isotopes with 1% accuracy. The U^{233} fission yield curve in this heavy mass region (140-150) is similar to that for U^{235} and is displaced from it by one mass unit in the light mass direction. (auth)

7983

MAGNETIC PROPERTIES OF URANIUM HYDRIDE. Dieter M. Gruen (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 23, 1708-10(1955) Sept.

The magnetic susceptibility of β UH_3 has been measured in the temperature range 191° to 603°K. From the high-temperature portion of the χ^{-1} vs. T curve one calculates a magnetic moment of 2.79 Bohr magnetons, with $\Delta = -137$°K. A ferromagnetic transition occurs in the neighborhood of 173°K. Magnetic moment measurements made in the temperature range 63° to 196°K in fields of 1550 to 8700 oersteds can be extrapolated to yield a saturation magnetic moment of about one Bohr magneton. (auth)

PATENTS

CHEMISTRY

7984

IODINE-132 GENERATOR AND SHIPPING CONTAINER. W. E. Winsche, L. G. Stang, W. D. Tucker, and G. J. Selvin (to U. S. Atomic Energy Commission). U. S. Patent 2,710,249, June 7, 1955.

A source of I^{132}, a method of recovering this radioactive isotope from the source, and an apparatus adapted to carrying out the method of the invention are described. Te^{132}, the radioactive parent of I^{132} is dispersed in a solid but readily liquifiable vehicle. Te^{132}, which is readily separated from other fission products resulting from the irradiation of natural uranium in a neutron flux, has a half life of 77 hr. The I^{132} formed in the solid mixture of Te^{132} and the vehicle, remains imprisoned until removed. It is separated out in a controlled amount at the point of usage by heating the source to liquify it, and then passing a stream of gas through the liquid mixture.

7985

CURIUM-AMERICIUM SEPARATION AND PURIFICATION PROCESSES. K. Street, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,711,362, June 21, 1955.

A novel, simple and useful process is presented for separating transuranic elements from each other and from the elements of the lanthanide series. The cations to be separated are first adsorbed on a cation-exchange resin such as a sulfonated polyvinyl aryl resin and then selectively eluted by strong, 6 to 13.3M hydrochloric acid.

7986

ELECTROLYTIC METHOD OF RECOVERING THORIUM FROM MONAZITE SAND. E. C. Pitzer (to U. S. Atomic Energy Commission). U. S. Patent 2,713,554, July 19, 1955.

A simple and effective method is described for separating thorium from rare earths by electrolyzing an aqueous acidic solution containing essentially thorium ions, rare earth ions and phosphate ions to a pH of not greater than 0.5, whereby thorium is precipitated as an insoluble phosphate which is readily removed from the solution containing the rare earth

ions. This electrolytic reduction of the acidity avoids the introduction of extraneous ions and avoids the formation of localized spots of high alkalinity resulting in minimizing the rare earths carried by the thorium phosphate precipitate.

7987

METHOD OF PRODUCING GADOLINIUM. F. H. Spedding and A. H. Daane (to U. S. Atomic Energy Commission). U. S. Patent 2,714,554, Aug. 2, 1955.

The production and separation of metallic Gd from mixtures of the chlorides of Sm, Eu, Yb, and Gd are described. Mixtures of the anhydrous chlorides of these rare earths predominating in Gd when reduced by reacting at an elevated temperature with an alkaline earth metal such as calcium result in the formation of metallic gadolinium substantially completely free of the other rare earths.

7988

METHOD OF SEPARATING CERTAIN PLATINUM GROUP METALS WITH CATION EXCHANGE RESINS. P. C. Stevenson, A. A. Franke, R. J. Borg, and W. E. Nervik (to U. S. Atomic Energy Commission). U. S. Patent 2,714,555, Aug. 2, 1955.

A procedure is described for the separation of the individual metals, Pt, Pd, Rh, and Ir from a mixture of these ions by means of selective adsorption and fractional elution from cation exchange resins. Material containing these metals is dissolved in a mixture of perchloric and nitric acids. Os or Ru ions present are volatilized by heating. The solution free of chloride was cooled and diluted, and then placed on a column of a suitable cation exchange medium such as the sulfonated aromatic hydrocarbon polymers. The Pt ions pass through the column. The Pd ions are eluted by 0.05M to 0.5M HCl. The Rh fraction is eluted with 2M HCl, and the Ir fraction with 6M HCl.

ENGINEERING

7989

ELECTROMAGNETIC PRESSURE GAGE. L. B. Vandenberg (to U. S. Atomic Energy Commission). U. S. Patent 2,710,538, June 14, 1955.

An electromagnetic pressure gage has been developed in which pressure is indicated by the amount of current required to maintain a pressure equal and opposite to the pressure to be measured. This is obtained by providing an electromagnetic pump in which an end of the pump inlet tube is closed and the other end of the pump outlet tube is open and immersed in liquid metal in a chamber, the pressure of which is to be measured. The pump armature current enters the inlet tube and leaves the pump by the outlet tube. The resistance of the tube will vary depending upon the extent to which it is filled by liquid metal.

MINERALOGY, METALLURGY, AND CERAMICS

7990

POLISHING METALS AND COMPOSITION THEREFOR. John G. Beach (to U. S. Atomic Energy Commission). U. S. Patent 2,711,364, June 21, 1955.

The chemical polishing of metal articles which predominantly consist of metals of Group IV, such as zirconium, hafnium, titanium, lead, tin or alloys containing at least one of these metals as the predominant ingredient is described. Polishing is accomplished by immersing the article in a solution containing 50 to 100 g of a water-soluble fluoride, 175 to 400 ml of a 30% fluosilicic acid, and 350 to 600 ml of a 70% nitric acid per liter of solution. The solution is advantageously maintained at a temperature of 60 to 85°F.

7991

METHOD OF APPLYING ADHERENT ELECTROPLATES TO ZIRCONIUM SURFACES. J. G. Beach, W. C. Schickner, and C. L. Faust (to U. S. Atomic Energy Commission). U. S. Patent 2,711,389, June 21, 1955.

A method is reported for cleaning zirconium surfaces and applying to them adherent electrodeposits. The etching solution comprises an aqueous solution of ammonium fluoride and hydrofluoric acid of a molar ratio between 1.2 and 3.0. The addition of about 1% of an aliphatic amine extends the preferred range of molar ratios to 1.0 to 3.0%. Preferred immersion times of 30 to 90 sec and a solution temperature of 100°F are stipulated.

7992

PRODUCTION OF CORROSION RESISTANT COATINGS ON METAL STRUCTURES. W. T. Miller and A. D. Kirshenbaum (to U. S. Atomic Energy Commission). U. S. Patent 2,711,972 June 28, 1955.

A technique is described for forming on a metal structure a coating resistant to corrosion by uranium hexafluoride and by halogens and metal halides in general. The flexible, firmly adherent, corrosion-resistant coating is achieved by providing on a metal structure a film of a natural or synthetic polymer and treating the polymer in situ with fluorine under suitable conditions.

PHYSICS

7993

ION SOURCE. M. G. Inghram and D. C. Hess (to U. S. Atomic Energy Commission). U. S. Patent 2,710,354, June 7, 1955.

Tertiary ions, ejected from the filament by bombardment of negative ions released from the slit plate, are deposited, resulting in a reduction of background peaks. These peaks become objectionable as the sensitivity of mass spectrometers is increased.

7994

TEMPERATURE CONTROL. E. V. Martin (to U. S. Atomic Energy Commission). U. S. Patent 2,712,073, June 28, 1955.

This patent pertains to isotope separation devices in which an ion source includes means for volatilizing a material by the controlled application of heat. An automatic control system having a thermostat is placed so that heat from the ionizing means affects it to the same extent as the heat affects the charge being volatilized.

7995

ELECTRICAL CONTROL CIRCUIT. H. G. Neil (to U. S. Atomic Energy Commission). U. S. Patent 2,712,074, June 28, 1955.

Electrical control circuitry have been adapted for use in isotope separating devices. The small drain current flowing through the negative electrode as a result of the loss of charge of the ions which are deposited thereon, is used to control the volatilization of the charge material. Transformers having their windings connected in opposition are connected to the ion source. An electronic coupling responsive to the drain current controls the transformers and hence the potential of the electrode.

7996

AUTOMATIC EMISSION CONTROL CIRCUIT. M. Bevis (to U. S. Atomic Energy Commission). U. S. Patent 2,712,075, June 28, 1955.

An automatic control of electron discharge devices has been developed, and the emissivity of a cathode in an isotope separating apparatus has been modified. An automatic timing arrangement is provided to raise periodically the temperature or emissions to a high value for a short interval until the arc is struck, and then to set the temperature down to an intermediate value in order to prolong the life of the cathode.

7997

ELECTRIC DISCHARGE DEVICE. W. R. Baker et al (to U. S. Atomic Energy Commission). U. S. Patent 2,712,078, June 28, 1955.

An apparatus has been developed to aid in space charge neutralization in a calutron. As low pressures are approached in electromagnetic isotope separation devices irregularities appear in the ion beam. This "blowing up" of the beam is due to a deficiency of electrons or negative ions along the path of the beam. A copious supply of electrons is supplied to overcome this space charge effect by irradiating the inner walls of the liner with ultraviolet light. As a result of this irradiation photoelectrons are liberated from the walls, some of which travel into and adjacent to the beam of ions. By virtue of their opposite charge with respect to the positive charge of the ions in the beam, these electrons tend to neutralize the space charge.

7998

CALUTRON. L. P. Hunter (to U. S. Atomic Energy Commission). U. S. Patent 2,712,079, June 28, 1955.

An electromagnetic isotope separator (calutron) is described. The separation of isotopes is effected by projecting ions in helical paths through a magnetic field whereby ions of different masses will be focused in zones spaced along the magnetic field. The ion beam projector is arranged to transmit a plurality of ion beams radially from a common source through the magnetic field so that they have a component parallel to that field. The projected ions follow a helical path of a radius dependent upon their particular masses. The receiver is annular in shape, and is effective throughout its periphery in collecting, neutralizing, and retaining ions.

7999

MARKER PULSE GENERATOR. W. R. Aiken (to U. S. Atomic Energy Commission). U. S. Patent 2,712,114, June 28, 1955.

A high stability marker pulse generator which is made up entirely of sections of coaxial transmission line arranged in a plurality of parallel-connected sections of line is designed. The coaxial cables will have graded lengths connected at one end to the output of a rectangular wave generator, the difference between the time delays being less than the duration of each rectangular wave output. A pulse forming stub, which has a time delay of less than half the minimum difference between the time delays of the cables is connected to the other end of the plurality of cables. A cancelling reflected voltage is produced during each period corresponding to the difference in delay times of the cables.

8000

SHORT CIRCUIT ELIMINATOR. J. W. Litton, et al (to U. S. Atomic Energy Commission). U. S. Patent 2,712,636, July 5, 1955.

Electric circuitry are outlined which may be useful for preserving or bringing about the veracity of meter readings in two or more circuits subject to localized cross currents of unknown and unpredictable magnitude, such as may occur in the case of an electromagnetic separator after a partial short arises between the deionizing electrodes which are relied upon to govern the operation of the device.

8001

SWITCH MECHANISM. W. A. Joerndt, et al (to U. S. Atomic Energy Commission). U. S. Patent 2,713,093, July 12, 1955.

An improved switch mechanism was designed that may be positively actuated by a pull pin or wire, and does not depend upon springs, levers, or the like to control establishment or interruption of an electric circuit, but overcomes these disadvantages by providing a positive construction and operation which is relatively simple and foolproof in operation.

8002

ACCELEROMETER. A. D. Wooten (to U. S. Atomic Energy Commission). U. S. Patent 2,713,097, July 12, 1955.

This patent relates to a device for operating a switch or mechanism at a predetermined velocity which is determined by the time integration of acceleration. This device employs means for providing an amplified output motion in response to the motion of another part of the accelerometer. Each member of a pair of bellows cooperates in transmitting a fluid from one bellows to a location adjacent to the other bellows. A partial collapse of the latter bellows in response to the entry of the fluid into the adjacent member is effected by the motion of a mass. The variation in the effective length of the bellows resulting from this collapse is the time integration of acceleration which actuates the desired switch or mechanism.

8003

ELECTRON CONTROL APPARATUS. H. W. Savage (to U. S. Atomic Energy Commission). U. S. Patent 2,713,640, July 19, 1955.

An apparatus has been developed for the suppression or control of oscillating electrons and ions induced by high voltage equipment operating under the influence of a strong magnetic field. It pertains particularly to electromagnetic isotope separation devices, in which a vacuum is present. A shield of lower potential is provided around the body of higher potential. It is constructed so that the electric field is in a direction such that the resultant between this electric field and the existing magnetic field exerts upon the electrons in question a force causing them to be "dumped" upon the high potential body. The means for shaping the electric field may be in the form of ribs on the hot body disposed at an angle to the magnetic field. There may be interleaving baffles forming part of the shield such that the ribs and the baffles form chevrons. A structure may be provided so that the pressure can be kept low. A tortuous passage for the electrons tends to inhibit the loss of vacuum.

8004

CALUTRON STRUCTURE. B. T. Wright and E. O. Lawrence (to U. S. Atomic Energy Commission). U. S. Patent 2,713,641, July 19, 1955.

An improved method is presented for adjusting the relationship between the accelerating electrode and the exit slit in the ion source in an electromagnetic type of isotope separating apparatus. The operation of a calutron can be improved by having the accelerating electrode offset

laterally slightly with respect to the exit slit in the ion source. The adjustment is made in the amount of offset by bodily rotating the ion source itself on trunnions. This adjustment is accomplished by means of push rods which cause the ion source to be tilted so that the exit end is accurately adjusted. This eliminates the need for making adjustments in the electrodes themselves so that the gap setting will not be disturbed, and the necessity for adjusting a component at a high potential is obviated since the ion source units are grounded.

8005

METHOD AND APPARATUS FOR DISCRIMINATING FREQUENCY MODULATED RECORDS. J. H. Scott, J. W. Valentine, and W. Gross (to U. S. Atomic Energy Commission). U. S. Patent 2,713,677, July 19, 1955.

An apparatus for eliminating the effects of speed variations of the recording medium in the discrimination of frequency modulated records is designed. The elimination of "wow" and "flutter" is accomplished inexpensively, without modifying the operation, at the cost of a low "noise" level even in the most unsatisfactory of circumstances, and without interference with the producing mechanism. A system for simultaneously reproducing and independently amplifying two records, the frequency modulated information record, and a simultaneously recorded constant frequency record, is described. The reproduced constant frequency is multiplied to be at least greater than the maximum frequency in the information record. In each period of the information record, a voltage pulse of duration equal to an integral number of periods of the multiplied frequency is generated. Means include a low-pass filter for averaging the generated pulses, and for canceling from the average the direct current component thereof.

8006

MASS SPECTROMETER SAMPLING SYSTEM. J. W. Riggle and J. B. Roberts (to U. S. Atomic Energy Commission). U. S. Patent 2,714,164, July 26, 1955.

Methods and apparatus are developed for controlling the pressure of a flowing gas to a mass spectrometer. This flow system comprises two flow restrictions positioned in the flow stream on opposite sides of the region in which it is desired to control the pressure. Upstream of the first flow restriction, the pressure is maintained constant at a value substantially more than twice the desired pressure while the pressure downstream of the second flow restriction is kept at any pressure, constant or variable, whose value is always substantially less than one half the desired pressure. By this device the pressure in the region between the flow restrictions is maintained constant at a value determined by the highest pressure in the system.

8007

ISOTOPE SEPARATING APPARATUS. J. D. Reid (to U. S. Atomic Energy Commission). U. S. Patent 2,714,165, July 26, 1955.

An arrangement is presented for suitably supporting and insulating the various component portions of an ion beam transmitter within a calutron. The primary support is derived from a metallic tube or cylinder extending horizontally from the face plate and being provided on its end with a vertically extending block of insulating material which supplies the support for the ion source. Only the metaliic tube is subject to tension; the insulating block is subject only to compression.

8008

CALUTRON STRUCTURE. C. Starr (to U. S. Atomic Energy Commission). U. S. Patent 2,714,166, July 26, 1955.

Improvements in the ion source of a calutron and related apparatus have been made for transmitting a ribbon like beam of positive ions, by a structural arrangement, which substantially fills the space between the high potential source and the supporting wall so that the space cannot be occupied by oscillating volumes of electrons.

8009

NEUTRON SELECTOR. I. Bloch (to U. S. Atomic Energy Commission). U. S. Patent 2,714,170, July 26, 1955.

The selection of neutrons of a predetermined velocity from the neutrons of various velocities emanating from a source, by means of apparatus adapted to sort out desired neutrons mechanically by a boron steel member rotatable at high speeds on an axis parallel to an associated beam of neutrons is described. The member contains a helical duct around the axis of rotation and within the rotatable member.

8010

NEUTRONIC REACTOR. E. Fermi and W. H. Zinn (to U. S. Atomic Energy Commission). U. S. Patent 2,714,577, Aug. 2, 1955.

A heavy water moderated neutron reactor has been designed to employ as fuel uranium metal of natural isotopic composition. The composite fuel rods are suspended from the cover so as to extend well into the reactor tank. Each rod is composed of an aluminum portion extending vertically into the tank from the cover and a thermal neutron fissionable portion secured to the lower end of the aluminum portion. Heavy water fills the tank to a level above the juncture of the aluminum portion with the fissionable portion of each composite rod so as to cause the fissionable portion to be wholly immersed.

8011

CALUTRONS. E. O. Lawrence (to U. S. Atomic Energy Commission). U. S. Patent 2,714,664, Aug. 2, 1955.

The patent relates to a calutron comprising a plurality of ion sources arranged to transmit a corresponding plurality of ion beams in an evacuated tank space so disposed in a substantially regular pattern in the tank and arranged to transmit a corresponding plurality of substantially regularly disposed ion beams within the evacuated tank space.

8012

ISOTOPE SEPARATING APPARATUS. W. C. Tunnell (to U. S. Atomic Energy Commission). U. S. Patent 2,714,665, Aug. 2, 1955.

An improved slit cleaning mechanism is developed embodying a straight-line-motion-producing device for causing the slit cleaning element to move in a straight line without binding or disalignment in the slit through which the ions of a calutron emerge eliminating the presence of unwieldy guide members in the immediate vicinity of the elongated opening of the ion source.

8013

CALUTRON OPERATION. J. H. Burney, W. H. Appleton, R. DeLiban, and G. M. Farly (to U. S. Atomic Energy Commission). U. S. Patent 2,714,667, Aug. 2, 1955.

A multiple beam type calutron including and ion source unit provided with a plurality of arc blocks having one or more arc chambers formed therein is described. In this source unit the electron emitting devices are provided with power supplies common to all of them, together with circuits

adapted for regulating each individual arc. In another aspect the conductors to two or more electron emitting devices may be combined electrically in such manner as to reduce the total number of heavy electrical conductors.

8014

REGULATOR FOR CALUTRON ION SOURCE. B. F. Miller (to U. S. Atomic Energy Commission). U. S. Patent 2,714,666, Aug. 2, 1955.

An automatic control arrangement for calutrons is arranged so as to prevent or suppress sparking flurries associated with the accelerating electrode and with the ion source itself thereby making the operation more uniform and steady. This is accomplished in part by substantially limiting the drain current to the ion source, in the event of sparking disturbances or the like, for a sufficient period of time to allow the disturbances to be cleared up.

8015

RADIATION RESPONSIVE DEVICE. W. H. Zinn (to U. S. Atomic Energy Commission). U. S. Patent 2,714,668, Aug. 2, 1955.

This patent relates to a simple and reliable apparatus which responds to neutron radiation of predetermined density in order to effect the operation of a neutron reactor control or safety device. The radiation responsive element comprises two thin elongated rectangular strips of metal of dissimilar materials having different coefficients of thermal expansion and different neutron capture cross section, adapted to move or flex in response to neutron density changes. Thermal compensating means may be included to render the operation of the device independent of changes in the ambient temperature.

8016

COMPENSATED ION CHAMBER. S. M. MacNeille (to U. S. Atomic Energy Commission). U. S. Patent 2,714,677, Aug. 2, 1955.

A neutron sensitive coated ionization chamber comprised of an inner, an outer, and an intermediate electrode defining adjacent ionization chambers to secure an increased range of sensitivity is described. Means are provided for adjusting the position of one electrode for changing the volume of one of the chambers.

8017

PULSE HEIGHT ANALYZER. W. E. Glenn, Jr. and A. E. Larsh, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,715,181, Aug. 9, 1955.

An improved pulse height analyzer has been designed utilizing a large number of channels or coincidence circuits without the use of a plurality of cathode ray tubes with a matrix interconnected coincidence circuit having a number of circuits that may be actuated by a single cathode ray tube pulse analyzer.

8018

AUTOMATIC CONTROL SYSTEM. C. W. Roeschke (to U. S. Atomic Energy Commission). U. S. Patent 2,715,185, Aug. 9, 1955.

A system has been developed for stabilizing operation of a klystron oscillator in a chosen mode of oscillation by providing an electronic regulating circuit which corrects variations in the voltages applied to the various electrodes.

8019

ISOTOPE SEPARATING APPARATUS. H. L. Hull and S. M. MacNeille (to U. S. Atomic Energy Commission). U. S. Patent 2,715,186, Aug. 9, 1955.

An improvement has been made in a calutron wherein the material is initially vaporized by a controlled internal radiant heater closely adjacent the charge material and a control circuit for energizing the heater in response to variations in the drain current.

8020

ELECTRON EMITTER. J. D. Reid (to U. S. Atomic Energy Commission). U. S. Patent 2,715,196, Aug. 9, 1955.

A secondary electron emitter filament of a calutron is designed in the form of a cylindrical tantalum rod having tapered ends, the taper on one end being longer than the taper on the other end with means for bombarding the filament with electrons. The tapered ends are seated in apertures in a resilient molybdenum yoke to facilitate removal of the filament.

UNITED STATES ATOMIC ENERGY COMMISSION

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Nuclear Science Abstracts

Vol. 9 No. 24A
December 31, 1955

ANNUAL INDEX
Volume 9

Technical Information Extension, Oak Ridge, Tennessee